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National Center
for Research Resources (U.S.)

Annual Report
# of Intramural Research

October 1, 1989
to
September 30, 1990

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1990

VRP Research Project (Z01 RS)

No.	Title	Investigator	Page No.
00001-20	Animal Model Development	C. T. Hansen	
00051-10	Reproduction in Mutant Sheep Used for the Study of Hyperbilirubinemia	L. D. Stuart	
00071-06	Development of Genetic Profiles for Inbred Laboratory Rodents	J. S. Crowell	
00077-06	Development of an Embryo Cryopreservation Program in Laboratory Animals	P. Schmidt	
00085-02	Modification of the Breeding Cycle of Sheep by Melatonin	L. D. Stuart	
00086-01	Characterization of a Feline Pneumonia Outbreak Associated with Group EF4 Bacteria	R. S. Weyant	
00087-01	Values of the N.I.H. WHHL Rabbit Colony	D. Barnard	
00088-01	Experimental Reconstitution of Embryonic Trophectoderm and Inner Cell Mass	M. C. Schiewe	
00089-01	Excreted Steroids in Primate Feces	S. K. Wasser	
00090-01	WHHL Rabbit Lipoprotein Phenotypes	D. Barnard	

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01-RR-00051-10 VR

PERIOD COVERED
October 1, 1989 through March 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
Reproduction in Mutant Sheep used for the Study of Hyperbilirubinemia

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

PI:	L.D. Stuart	Chief	UU, ACS, VRP, NCRR
Others:	D.E. Wildt	Reproductive Physiologist	NZP, Smithsonian Institution
	S.C. Kalser	Director	Liver Disease Pro., DDN, NIAID
	P.K. Chakraborty	Head	Research Division, Dept. of OB-GYN, USUHS

COOPERATING UNITS *(if any)*
Digestive Diseases and Nutrition Program, National Institutes of Arthritis, Metabolism and Digestive Diseases

LAB/BRANCH
Veterinary Resources Program

SECTION
Animal Center Section

INSTITUTE AND LOCATION
NCRR, NIH, Bethesda, Maryland 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
.2	.1	.1

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

A specific genetic strain of Corriedale sheep is used as an animal model for the study of liver pathophysiology, specifically, hyperbilirubinemia (Dubin-Johnson Syndrome). This project is concerned with increasing the numbers of animals available for research by the controlled breeding of individuals which genetically transmit this character. This project is utilizing what is considered to be the only existing Corriedale sheep homozygotic for this trait. Efforts are being made to obtain both homozygous and heterozygous offspring from these highly inbred individuals. Semen collected artifically from the homozygotic rams was diluted in various cryoprotective extenders and then freeze preserved. This will ensure the long term availablity of male gametes for artifical insemination. Overall this project allows prepetuation of this specific gene pool and ensures availability of research animal for future investigations of Dubin-Johnson Syndrome and related metabolic disorders.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01-RR-00071-06 VR

PERIOD COVERED

Octover 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Development of Genetic Profiles for Inbred Laboratory Rodents

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

J.S. Crowell, Geneticist	Comparative Pathology Section, VRP, NCRR
S.L. Finley, Chemist	Comparative Pathology Section, VRP,NCRR

COOPERATING UNITS (if any)

Small Animal Section, VRP, NCRR

LAB/BRANCH

Veterinary Resources Program

SECTION

Comparative Pathology Section

INSTITUTE AND LOCATION

NCRR, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.2	0.15	0.05

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

This continuing project is designed to identify and locate on the chromosomes of inbred rodents specific inherited characteristics. In addition to being utilized in a wide variety of biomedical research, this knowledge can substantially increase the ability of the Genetic Monitoring Unit to Perform its basic mission of genetic quality assurance. Major areas of interest include the characterization of genetic traits by biochemical, immunological, and molecular biological techniques as well as chromosome mapping by standard genetic analysis. This genetic characterization is used to explore new animal models of pathogenesis.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01-RR-00085-02 VR

PERIOD COVERED
October 1, 1989 through March 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
Modification of the Breeding Cycle of Sheep by Melatonin

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

PI:	L.D. Stuart	Chief	UU, ACS, VRB, DRS
Others:	D.M. Jarrell	Chief	PU, ACS, VRB, DRS
	L. Tamarkin	Assistant Prof.	University of Maryland
	M.A.A. Namboodiri	Assistant Prof.	Georgetown University
	J.E. Pierce	Guest Researcher	NHLBI, NIH

COOPERATING UNITS *(if any)*

LAB/BRANCH
Veterinary Resources Program

SECTION
Animal Center Section

INSTITUTE AND LOCATION
NCRR, NIH, Bethesda, Maryland 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
.6	.1	.5

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

This project is designed to control the breeding cycle in sheep and to breed ewes out of season. Data exists that indicated the rhythmic secretion of the pineal hormone, melatonin, regulates seasonal breeding in a variety of mammals, including sheep. Sheep usually breed in the fall when elevated levels of ciruclation melatonin are longer (mimicking the longer night). During the spring when levels of melatonin are shorted, sheep enter a period of anestrus. Elevated levels of melatonin will be maintained by daily feeding of melatonin.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01-RR-00086-01 VR

PERIOD COVERED

October 1, 1989 through September 30,1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Characterization of a feline pneumonia outbreak associated with Group EF-4 bacteria.

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

PI = Robbin S. Weyant	Comparative Pathology Section, VRP, NCRR
Jennifer Burris	Comparative Pathology Section, VRP, NCRR
Donald Nichols	Comparative Pathology Section, VRP, NCRR
Elaine Woo	Comparative Pathology Section, VRP, NCRR
Vikki Kinsey	Comparative Pathology Section, VRP, NCRR
Debra Sinsabaugh	Comparative Pathology Section, VRP, NCRR

COOPERATING UNITS (if any)

NONE

LAB/BRANCH

Comparative Pathology Section/VRP/NCRR

SECTION

Comparative Pathology Section

INSTITUTE AND LOCATION

NCRR/VRP/CPS Bldg 28A Bethesda, MD

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.1	0.06	0.04

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

During January 1990 five cats from a recently imported colony of 48 cats at the NIHAC developed fatal respiratory tract infections. Bacterial cultures of lung tissues yielded CDC Group EF-4 from four cats. Although sporadic cases of feline pneumonia associated with this poorly defined bacterial group have been reported, this outbreak within a single colony appears to be unique. An unusually high incidence of fatalities, not due to EF-4 bacteria, continued to occur in this colony over the next few months. The purposes of this study are: (1) to further characterize the case-associated isolates by comparing them with control EF-4 strains obtained from other sources; (2) to assess the pathology of the lesions associated with EF-4 infection; and (3) to review the medical histories and clinicopathologic findings from cats which died of EF-4 pneumonia and from cats which died from other causes to determine if there were any underlying diseases which contributed to the fatalities in this colony.

Preliminary sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS PAGE) experiments on the four outbreak-associated EF-4 strains suggest that these strains may belong to a clonal group that is unique from the control strains. These findings will be further investigated using plasmid and substrate utilization analyses. Bacteriological results will then be compared with clinical and pathologic findings to determine if the presence of this particular clone correlates with any particular pathogenic pattern. If these results are consistent, then virulence studies involving in-vitro and in-vivo systems will be designed.

DEPARTMENT OF HEALTH AND HUMAN SERVICES • PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01-RR-00087-01 VR

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Values of the N.I.H. WHHL Rabbit Colony

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

PI:	Dennis Barnard	Biologist	SAS, VRP, NCRR
	Victoria Hollifield	Veterinarian	SAS, VRP, NCRR
	Carl T. Hansen	Geneticist	SAS, VRP, NCRR
	Joseph J. Knapka	Physiologist	SAS, VRP, NCRR

COOPERATING UNITS (if any)
SAS, VRP
CPS, VRP

LAB/BRANCH
Veterinary Resource Program

SECTION
Small Animal Section

INSTITUTE AND LOCATION
NCRR, NIH, Bethesda, MD. 20892

TOTAL MAN-YEARS: 1.0	PROFESSIONAL: .7	OTHER: .3

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

OBJECTIVE:

The Veterinary Resources Program, National Center for Research Resources, has established a Watanabe Heritable Hyperlipedimic rabbit (WHHL) breeding colony to be used as a resource for investigators. In order to better serve the scientific community, the serum cholesterol and triglyceride values of the colony are to be characterized.

METHODS:

The proposed course involves bleeding rabbits at weaning, three months, seven months, and 12 months. The serum will be analyzed for lipoprotein cholesterol and triglycerides.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01-RR-00089-01 VR

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
Excreted Steroids in Primate Feces

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

S.K. Wasser	Research Fellow	Smithsonian Institution
J.L. Southers	Veterinarian	VRP, NCRR
D.E. Wildt	Physiologist	Smithsonian Institution

COOPERATING UNITS *(if any)*
Smithsonian Institution

LAB/BRANCH
Veterinary Resources Program

SECTION
Veterinary Medicine and Surgery Section

INSTITUTE AND LOCATION
NCRR, NIH, Bethesda, Maryland 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.2	1.0	0.2

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

This study is a continuation of work to validate noninvasive techniques to measure biologically meaningful levels of reproductive and adrenal steroid hormones in feces of captive-maintained baboons. Results will serve to establish the general validity of these techniques for use on a variety of species in captivity and the field. Captive studies are: 1) identifying fecal and urinary metabolites of estradiol (E2), progesterone (P4), cortisol (C), dehydroepiandosterone (DHEA), and testosterone (T), as well as respective excretion rates after radiolabel infusion; 2) developing indices of nonspecific steroid excretion rate, particularly those associated with GI transit time; 3) testing the influence of dietary fiber on fecal steroid excretion rate, and the potential of eliminating existing effects using nonspecific excretion rate indices; 4) correlating longitudinal fecal steroid excretion profiles with blood hormone secretory patterns, urinary metabolite excretion, and visual markers (e.g. menses and sex skin turgescence) during natural reproductive cycles and, in the case of C and DHEA, after acute challenges with exogenous ACTH; 5) determining if fecal P4 excretion following time-mating is useful indicator of early pregnancy or spontaneous abortion. These excreted steroid techniques are likely to provide an important noninvasive tool for interrelating reproductive function and adrenal activation with naturally and/or artificially occurring socio-ecological events.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01-RR-00088-01 VR

PERIOD COVERED

January 1, 1990 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Experimental Reconstitution of Embryonic Trophectoderm & Inner Cell Mass

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

PI:	Mitchel C. Schiewe	NRC Research Associate	SAS, VRP, NCRR
Others:	Patricia M. Schmidt	Physiologist	SAS, VRP, NCRR
	Carl T. Hansen	Geneticist	SAS, VRP, NCRR

COOPERATING UNITS *(if any)*

LAB/BRANCH

Veterinary Resources Program

SECTION

Small Animal Section

INSTITUTE AND LOCATION

NCRR, NIH, Bethesda, MD. 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER.
1.2	1.2	0

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

The purpose of this project is to develop practical and efficient procedures for isolating the placental (trophectoderm) and fetal (inner cell mass) cellular precursors from the developing blastocyst and then successfully reconstruct the blastocyst. This process, known as blastocyst reconstitution, likely is important in attempting to overcome fetal rejections associated with interspecies embryo transfer. By injecting the inner cell mass of one species (or genotype) into the trophectoderm vesicle of the recipient genotype, it may be possible to eliminate fetal loss associated with immunological rejection and, thus, increase the reproductive potential of a valuable genotype (e.g., rare animal model or endangered species). The proposed experiments will answer specific questions, while developing effective procedures for isolating zona pellucida-enclosed trophectoderm vesicles using physical and chemical methods and inner cell masses using heterologous antibody sources.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01-RR-00077-06 VR

PERIOD COVERED

October 1, 1990 to September 30, 1991

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Development of an Embryo Cryopreservation Program in Laboratory Animals

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

PI:	Patricia M. Schmidt	Physiologist	SAS, VRP, NCRR
Others:	Carl T. Hansen	Geneticist	SAS, VRP, NCRR
	Victoria Hollifield	VMO	SAS, VRP, NCRR
	Mitchel C. Schiewe	NRC Research Associate	SAS, VRP, NCRR
	William F. Rall	Guest Researcher	VRP, NCRR
	David E. Wildt	Guest Researcher	VRP, NCRR

COOPERATING UNITS *(if any)*

LAB/BRANCH

Veterinary Resources Program

SECTION

Small Animal Section

INSTITUTE AND LOCATION

NCRR, NIH, Bethesda, MD. 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
3.4	2.4	1.0

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

The program objective is to facilitate the management of the NIH Animal Genetic Resource (NIHAGR) through development and utilization of embryo/gamete collection and handling techniques for cryobanking genetic material and improving reproductive potential. The NIHAGR maintains an array of animal model species and, within species, a vast number of invaluable genotypes used in biomedical research. Embryo preservation uses a cryoprotectant in the freezing medium which allows sufficient dehydration to protect the blastomeres during freezing. Following warming and dilution of the cryoprotectant, embryos are cultured to assess *in vitro* development. Transplantation of embryos into recipient females monitors *in vivo* development and thus biological competence. Cryobanked embryos are maintained until needed for rederivation. The primary focus of laboratory efforts is the study and optimization of cryobanking technology in mice, rabbits and rats. A major research finding is that embryo freezability is confounded and influenced markedly by genotype. Such responses have been examined in over 64 mouse genotypes, most of which display genotype-specific survival rates to standardized embryo freeze-warming procedures. Ancillary projects investigate the comparative aspects of improving long-term embryo storage with particular emphasis on cryoprotectants and enhancing methods for embryo freezing, warming, dilution and transfer. Efforts in the rabbit focus on collection procedures and preservation of embryos using a newly developed vitrification procedure. Initial attempts also have begun to recover rat embryos. Preliminary attempts also have been initiated to *in vitro* fertilize ova as well as cryopreserve sperm. These techniques will be especially important for salvaging limited genetic material from individuals or genotypes with poor *in vivo* fertility.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01-RR-00090-01 VR

PERIOD COVERED

October 1, 1990 to September 30, 1991

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

WHHL Rabbit Lipoprotein Phenotypes

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

PI:	Dennis Barnard	Biologist	SAS, VRP, NCRR
	Steven Finley	Biochemist	CPS, VRP, NCRR
	Victoria Hollifield	Veterinarian	SAS, VRP, NCRR
	Nicholas Papadopoulus	Biochemist	CP, CC
	Jim Crowell	Geneticist	SAS, VRP, NCRR
	Carl T. Hansen	Geneticist	SAS, VRP, NCRR

COOPERATING UNITS *(if any)*

SAS, VRP
CPS, VRP
CP, CC

LAB/BRANCH

Veterinary Resources Program

SECTION

Small Animal Section

INSTITUTE AND LOCATION

NCRR, NIH, Bethesda, MD. 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.5	1.0	0.5

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

OBJECTIVE:

The Veterinary Resources Program, National Center for Research Resources, has established a Watanabe heritable hyperlipidemic rabbit (WHHL) breeding colony to be used as a resource for investigators. Watanabe et al. have reported that there are two types of WHHL rabbits; those with early development and high incidence of coronary atherosclerosis and those with late development and low incidence of coronary atherosclerosis. It has also been shown that by identifying either type of WHHL rabbit it could be selectively bred to produce progeny exhibiting the particular phenotype of interest. Recently, it was reported that these two types of WHHL rabbits can be differentiated by their lipoprotein phenotypes. The rabbits with a high incidence of coronary atherosclerosis exhibit a lipoprotein phenotype similar to type III hyperlipidemia.

The purpose of this study is to characterize the lipoprotein phenotypes in the N.I.H. WHHL rabbit colony so that the two types of WHHL rabbits can be identified.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01-RR-0001-20 VR

PERIOD COVERED

September 1, 1990 - August 31, 1991

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Animal Model Development

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

PI: Carl T. Hansen, SAS, VRP, NCRR

COOPERATING UNITS *(if any)*

LAB/BRANCH

Veterinary Resources Program

SECTION

Small Animal Section

INSTITUTE AND LOCATION

NCRR, Bethesda, MD

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
.5	.5	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

The basic aim of the project is to develop in small animals, models for the study of these human diseases which have a major impact on public health. The effort has been concentrated into four areas, models of immunodeficiency in mice and rats, a model for the study of rheumatoid arthritis in the rat, a model of Insulin Independent Diabetes Mellitus (IIDM) in the rat, and rat models for the study of chemical addiction.

1. Immunodeficient Mice: It has been shown that by appropriate treatment, the spleen cells of these mice become reconstituted with human lymphocytes.

2. Rheumatoid Arthritis in Rats: This model has established the interrelationship between the immune and nervous system contributing to this disease.

3. IDDM models in Rats: The model exhibits nearly all of the symptoms found in human to include vision, nervous, kidney, and other soft tissue involvement.

4. Chemical Addiction in Rats: Addiction and tolerance to various chemicals have a genetic basis in that they respond to selective breeding.

BIOMEDICAL ENGINEERING AND INSTRUMENTATION PROGRAM
NATIONAL CENTER FOR RESEARCH RESOURCES
NATIONAL INSTITUTES OF HEALTH

ANNUAL REPORT FY 1990

Dr. Murray Eden, Director

BEIP RESEARCH PROJECTS (Z01 RR)

10001-22	Pharmacokinetics	R.L. Dedrick	1
10034-13	Three-Dimensional Histological Reconstruction	S.B. Leighton	7
10039-13	Biophysical Instrumentation and Methodology	M.S. Lewis	9
10043-13	Fiber Optics Probes	J.I. Peterson	12
10097-10	Studies in Cardiovascular Dynamics	R.S.Chadwick	14
10098-10	Laser Instrumentation for Vitreous and Cardiovascular Microsurgery	R.F. Bonner	17
10109-10	Adjunctive Heat Treatment of Cancer	R.L. Levin	20
10112-10	Analysis of Microcirculatory Blood Flow by Laser Doppler Scattering	R.F. Bonner	24
10122-09	Microcomputer Applications for the NIH Bio-Technology Unit (Pilot Plant)	T.R. Clem	27
10146-08	Prosthetic Urethral Sphincter	S.B. Leighton	29
10162-08	Wound Healing: Biology and Rheology	T.L. Talbot	31
10184-07	Physical Chemistry of Biological Macromolecules	M.S. Lewis	34
10204-06	Cell Handling Studies	S.B. Leighton	38
10210-06	Electronic Patient Monitoring System	H.E. Cascio	40
10213-06	Vitreous Fluorophotometry Analysis	P.M. Bungay	42
10214-06	Photoradiation Therapy	P.D. Smith	47
10225-06	Processing of High Resolution Electron Micrographs	M. Unser	51
10238-06	Automation of BEIB Information Processing Functions	J.R. Ellis	54
10240-05	Clinical Measurement of Microvascular Blood in Sickle Cell Patients	E.C. Walker	58
10252-04	Physiological Monitoring System for Sepsis Models	E. Walker	61
10256-04	Mechanical Prosthetic Heart Valve Tester	T.L. Talbot	62
10257-04	Analysis of Propagation of Light in Turbid Biological Tissues	R.F. Bonner	64

TABLE OF CONTENTS (CONT'd)

10258-04	Photochemical Inactivation of Virus and Bacteria in Blood	R.F. Bonner	66
10259-04	Visual Target Tracking Ability Assessment System	T.R. Clem	68
10260-04	Real Time High Performance Confocal Laser Scanning Optical Microscope	S.R. Goldstein	70
10267-04	A Low Noise Electrometer for an Automated Hemoglobin Oxygen Equilibrium Curve Measurement System	H.E. Cascio	73
10270-04	Computer-Assisted Analysis of Echocardiograms	M. Unser	75
10271-03	Strain Rate Dependency of Wound Breaking Strength	T.L. Talbot	77
10272-03	Photometry for Photo-Dynamic Therapy	W. Friauf	79
10273-03	Continuum Models of the Dynamics of Gels	P. Basser	82
10274-03	A Non-invasive Method to Measure and Monitor Contact Stress in Tissue	P. Basser	84
10276-03	Microdialysis Probe Studies	P. Bungay	86
10283-03	A Micro-Computer-Based Flow Cytometry Data Collection and Analysis System	C.P. Mudd	90
10284-03	Measurement of the Binding Heats of Oxygen to Hemoglobin	C.P. Mudd	93
10285-03	Determination of Binding Enthalpies of Anthracycline Drugs to DNA Host Cells	C.P. Mudd	95
10286-03	High Speed Differential Stopped Flow Calorimeter	C.P. Mudd	97
10289-03	Tantalum Batch Calorimeter for *In Vitro* Cell Studies	C.P. Mudd	99
10296-03	Experiments with a High Resolution Field-Emission STEM	R.D. Leapman	101
10300-02	Myocardial Cell Contractility Study	T.L. Talbot	104
10301-02	Particle Size Distributions of Nebulized Drugs	E.C. Walker	105
10302-02	Calibration System for Electronic or Automated Sphygmomanometers	E.C. Walker	106
10303-02	Assessment of Scratching in Biliary Cirrhosis Patients	T.L. Talbot	107
10305-02	CC Image Management System	R.L. Levin	109

TABLE OF CONTENTS (CONT'd)

10306-02	Liposome Photolysis and Antibody Carriers for Targeted Drug Delivery	P.D. Smith	111
10307-02	Pulse Oximeter Calibrator	J.M. Schmitt	114
10308-02	Reflectance-Mode Pulse Oximetry	J.M. Schmitt	116
10309-02	Signal Conditioning and Data Acquisition System for Sleep Deprivation Studies	C.P. Mudd	119
10310-02	Microcalorimeter Meaurements of DNA-Protein Interactions	C.P. Mudd	121
10313-02	High Speed Multi-Channel Spectrophotometer	W.S. Friauf	123
10314-02	Pulsed Photo-Dynamic Therapy	W.S. Friauf	125
10315-02	A Model of Magnetic Stimulation of a Nerve Fiber	B.J. Roth	127
10316-02	Calculation of Electric Fields During Magnetic Stimulation	B.J. Roth	129
10317-02	New Algorithms for the Biomedical Image Processing	M. Unser	131
10318-02	Apple Macintosh II Based Image Processing Workstation	M. Unser	134
10319-02	Calculation of Electrical Activity in Thick Strands of Cardiac Tissue	B.J. Roth	137
10320-02	Computerized Methods for Analyzing Two-Dimensional Agarose Gel Electrophoretograms	A. Aldroubi	138
10322-02	Data Acquisition System for an Ultrahigh Resolution Dedicated STEM	C.R. Swyt	140
10324-02	*In Vitro* Hemodynamic Models for Cardiovascular Studies	R.J. Lutz	143
10325-02	Noninvasive Magnetic Measurement of Current in Peripheral Nerve	B.J. Roth	146
10327-02	Mass Mapping of Macromolecular Assemblies	R. Leapman	148
10329-02	Optimized Mammography Instrument	A. Eidsath	150
10330-02	Kinetics of Erythrocyte Sickling in Physiological Conditions	A. Eidsath	152
10331-01	Microanalysis of Rapidly-Frozen Tissue in the Field-Emission STEM	R. Leapman	154

TABLE OF CONTENTS (CONT'd)

10332-01	Characterization of Fluorine-Labelled Compounds by Parallel EELS	R. Leapman	156
10333-01	Applications of Artificial Neural Networks in Biomedical Image Processing	J. Schmitt	158
10334-01	Applications of Synthetic Membranes to Biomedical Research	P. Bungay	160
10335-01	Design and Implementation of an Equipment Management Program	E. Walker	164
10336-01	Kinetics of Folate Metabolism	P. Morrison	165
10337-01	Nuclear Medical Imaging	A. Markowitz	168
10338-01	Resolution of Equipment Safety Incidents and Manufacturers' Recalls	R. Corsey	170
10339-01	Radiological Science Research and Training Program	R. Levin	171
10340-01	Interstitial Pressure and Transport in Neural Tissue	P. Basser	173
10341-01	Muscle Strength Testing System	T. Clem	175
10342-01	Computer Based Dual Pump HPLC Driver System	J. Cole	177
10343-01	B-Spline Signal Processing Techniques	M. Unser	179
10344-01	Computer Analysis of Ultrasound Images of the Tongue	M. Unser	181
10345-01	Functional Test Procedures for Medical Equipment	R. Corsey	183
10346-01	Evaluation of AC Power Quality in the Clinical Center	R. Corsey	184
10347-01	Evaluation of Medical Equipment for Use in the Clinical Center	R. Corsey	185
10348-01	An Infrared Strobe CCD Television Camera Unit	H. Cascio	186
10349-01	Image Field Modification for Quantitative Microscopy	P. Smith	188
10350-01	Nuclear Magnetic Resonance (NMR) Instrumentation	D. Hoult	190
10351-01	High Resolution Patch Clamp Techniques	A. Markowittz	194
10352-01	Quantitative Characterization of Ciliated Tracheal Epithelial Cell Cultures	J. Ellis	196

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10001-22 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Pharmacokinetics

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

R.L. Dedrick	Chief,CHES	BEIP, NCRR
Others:		
C. Sung	Staff Fellow	BEIP, NCRR
F.F.Farris	Southeastern Coll.of Pharmacy	
F.G.King	North Carolina A&T State Univ.	
R.J. Lutz	Chemical Engineer	BEIP, NCRR
P.F. Morrison	Physical Scientist	BEIP, NCRR

COOPERATING UNITS *(if any)*

NM-CC, DR-CC, NTP-NIEHS, SNB-NINDS, LKEM-NHLBI, PB-NCI

LAB/BRANCH

Biomedical Engineering and Instrumentation

SECTION

Chemical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
2.0	1.5	0.5

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

  ☐ (a1) Minors

  ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Pharmacokinetic models are developed for the distribution and disposition of drugs, environmental contaminants, and endogenous metabolites in animals and humans. They provide a plausible set of equations that can be used to extrapolate data from animals to humans and thereby improve chemotherapy and risk assessment. Consideration of regional drug delivery includes intra-arterial infusion, intracavitary administration, and direct intratumoral infusion. Drug streaming from arterial catheters leading to nonuniform distribution of drug in the infused tissue previously shown in rats and monkeys has been demonstrated in human subjects. Work is in progress on the development of a physiological pharmacokinetic model for methyl mercury and inorganic mercury in the rat. Work is also in progress on the adaptation of a pharmacokinetic model for cis-diamminedichloroplatinum(II) to other platinum-containing complexes. Increased emphasis has been placed on the pharmacokinetics of macromolecules such as monoclonal antibodies and immunotoxins.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10034-13 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Three-Dimensional Histological Reconstruction

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

S.B. Leighton	Mechanical Engineer	BEIP, NCRR
A.M. Kuzirian	Neuroanatomist	LB, NINCDS

COOPERATING UNITS (if any)
LB, NINCDS

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Mechanical Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0	0	

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

A semi-automatic system for acquiring three-dimensional structural information about histological material is being developed. The system should be faster and more reliable than techniques that use serial sections, although resolution may be limited. In brief, an embedded tissue block will be fixed relative to a scanning electron microscope imaging system, the surface of the block will be imaged and the image stored, and successive slices will be removed by a built-in microtome. Handling and registration of thin sections will thus be eliminated. Human and computer pattern recognition will transform the resulting set of images into a three-dimensional reconstruction. Oxygen plasma etching has been found to give sufficient topographic relief that the resolution of the images is now limited by the SEM and not by the preparation technique. The images of Hermissenda Crassicornis obtained by this technique correlate well with TEM images of the same tissue.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10039-13 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Biophysical Instrumentation and Methodology

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

Marc S. Lewis	Research Chemist	BEIP, NCRR
Allen P. Minton	Research Chemist	LBP, NIDDK

COOPERATING UNITS (if any)

LBP/NIDDK

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Microanalysis

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.4	0.4	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

The project is designed to develop new instrumentation and methods and to improve existing instrumentation and techniques for the characterization of biological macromolecules and for study of their interactions. Analytical ultracentrifugation, the techniques ancillary to it, and methods of data analysis using mathematical modeling appropriate for these techniques are the major areas of interest.

Studies on the application of mathematical modeling to problems of ultracentrifugal analysis have continued. The applications of these studies are described in the project report 10184-07. Further progress has been made in the development of data acquisition systems. Work is continuing on a direct digital acquisition system using the Macintosh II. New methods of performing experiments and analyzing data have been developed and work is continuing in this area. In particular, (1) extensive studies on the concentration dependence of sedimentation coeffecients have been investigated; (2) the PC version of MLAB has been very extensively used and evaluated; (3) studies on the possible application of singular value decomposition techniques to the study of data from heterogeneous associations is being initiated.

DEPARTMENT OF HEALTH AND HUMAN SERVICES • PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER
Z01 RR 10043-13 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Fiber Optic Probes

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

John I. Peterson	Chemist	BEIP, NCRR
Einar Stefansson	Chairman	Dept. Ophthal., University of Iceland

COOPERATING UNITS (if any)
University of Iceland

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Chemical Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
.8	.8	

CHECK APPROPRIATE BOX(ES)
☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

A suitable device is needed for the direct measurement of oxygen partial pressure (PO_2) in blood and tissue for both clinical and research applications. A fiber-optic sensor is ideal for this application, with the advantage for physiological use of very small size and flexibility, safety, and low cost. An optical PO_2 sensor has been developed, based upon the principle of fluorescence quenching by oxygen. The feasibility of the sensor and its satisfactory performance have been demonstrated in *in vitro* and *in vivo* tests in preceding years. The development of the sensor in the form of a needle probe was done, and an instrument suitable for research applications was developed.

The system was used in experiments to measure PO_2 in the eyes of anesthetized dogs, in comparison with polarographic electrode measurements of PO_2. This work was done to evaluate the suitability of the sensor for studies of diabetic retinopathy. It resulted in the design and construction of an instrument with performance improvements suitable for further experiments in this and other projects.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10097-10 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Studies in Cardiovascular Dynamics

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

R.S. Chadwick	Head, Theor. Biomech.Group	BEIP, NCRR
J. Ohayon	Lecturer	U. of Paris
M. Lewkowicz	Visiting Fellow	BEIP, NCRR
C. Oddou	Professor	U. of Paris
A. Azancot-Benisty	Senior Researcher	INSERM U. 120
B. Levy	Director	INSERM U. 141
A. Al Droubi	Staff Fellow	BEIP, NCRR
M. Domanski	Staff Fellow	Cardiology, NHLBI

COOPERATING UNITS (if any)

INSERM U.120 U.141, University of Paris XII, Laboratory of Physical Mechanics Cardiology Branch, NHLBI

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Mechanical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.8	1.8	

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

We have refined our existing model for myocardial and ventricular mechanics to include the effects of collagen on the elasticity of the myocardium and filling of the left ventricle, wall thickness and curvature effects, pathological fiber organization, myocardial blood flow, myocardial oxygen demand, effects of electrical activation patterns, interaction with right ventricle, and dynamic vibrations. The model was used in conjunction with ultrasonic kinematic data, gated radionuclide ventriculography, and left heart catheterization data, and implanted ultrasonic crystals to determine performance and contractility parameters. The physiological relationships between phasic coronary arterial, venous, and left ventricular pressure and blood flow were determined during a long diastole and control conditions A theoretical model was developed to describe contraction of arterioles, and will be used to study mechanisms of hypertension. Theoretical models investigating residual stress in the myocardium and contraction with an ischemic zone are being developed. Congentital heart defects with right ventricular pressure and/or volume overload have been modelled. The hypothesis of independence of mean circumferential shortening velocity on preload is being investigated via the model and echocardiographic patient data.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10098-10 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Laser Instrumentation for Vitreous & Cardiovascular Microsurgery

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

R.F. Bonner	Physicist	BEIP, NCRR
P.D. Smith	Physicist	BEIP, NCRR
M. Leon	Sr. Investigator	CB, NHLBI
A. Bartorelli	Fellow	CB, NHLBI
P. Douck	Guest Researcher	BEIP, NCRR
C. Kupfer	Director	NEI

COOPERATING UNITS (if any)

Clinical Branch, NEI; Optical Science Branch, Naval Research Lab; Cardiology Branch and Surgery Branch, NHLBI; Quantronix Corp.; Infrared Fiber Systems; MCM Labs; Intratherapy, Inc

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Electrical and Electronic Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
2.5	2.5	

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

This program covers the long-standing development of laser microsurgical techniques; its primary focus for the last 3 years has been in cardiological applications, in particular laser angioplasty. Excimer lasers coupled to fused silica fibers were examined, as well as more conventional sources (pulsed carbon dioxide and Nd:YAG lasers and continuous-wave argon and dye lasers). New IR laser sources have been developed (in conjunction with Naval Research Lab and Quantronix Corp.) which utilize strong water absorption and can be transmitted through low-loss, cladded optical fibers. They include the first use of the Erbium:YAG laser @2.94um through zirconium fluoride optical fibers and the Thulium:YAG (Cr-doped) @ 1.96-2.01um through low-OH silica optical fibers.

Our collaborations with the NRL and various industry groups have led to a variety of prototype laser microsurgical systems for angioplasty studies. The collaboration with MCM Labs has led to clinical trials of peripheral and, more recently, coronary laser angioplasty using a pulsed dye laser with computer-controlled fluorescence guidance. Application of our infrared lasers (particularly the Tm:YAG and silica optical fibers) to laser angioplasty systems is proceeding with parallel development of a clinical infrared version of the fluorescence guidance system and a new intravascular ultrasound/laser catheter.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10109-10 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Adjunctive Heat Treatment of Cancer

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

R.L. Levin	Biomedical Engineer	BEIP, NCRR
D. LeBihan	Fogarty Scientist	DR, CC
D. Hoult	Physical Scientist	BEIP, NCRR
R. Turner	Fogarty Scientist	BEIP, NCRR
C-N Chen	Physical Scientist	BEIP, NCRR
E.J. Glatstein	Chief	ROB, NCI

COOPERATING UNITS (if any)

Radiation Oncology Branch, NCI; Diagnostic Radiology, CC

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Mechanical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.4	0.2	0.2

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

The purpose of this project is to develop adjunctive hyperthermia modalities for cancer treatment through theoretical and experimental studies of the spatial and temporal variation in the temperature field of tissues subjected to radio-frequency electromagnetic radiation. Currently, we are (1) measuring the patterns of energy deposition produced by a mini-annular phased array (MAPA) applicator within various types of extremity phantoms; (2) describing the electromagnetic fields of a MAPA in terms of its design parameters; (3) describing the transient thermal profiles within limbs produced by a MAPA; and (4) describing the systemic temperature and cardiac changes associated with heating various regions of the body. We are also developing a non-invasive method for measuring temperature using magnetic resonance imaging. These studies are forming the basis for the clinical system currently being tested under the auspices of a recently approved Phase I clinical protocol.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10112-10 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Analysis of Microcirculatory Blood Flow by Laser Doppler Scattering

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

R.F. Bonner	Physicist	BEIP, NCRR
T.R. Clem	Electrical Engineer	BEIP, NCRR
H. Wagner	Section Chief	LNNS, NINCDS
T. Delaney	Sr. Investigator	ROB, NCI
R. Nossal	Sr. Res. Physicist	PSL, DCRT

COOPERATING UNITS (if any)

HB, NHLBI; CB NEI; LCI, NIAID; ROB, NCI; SN, NINCDS; LAP, DCRT; MedPacific,Inc, Seattle,WA; TSI, Inc, St. Paul,MI; Neurology and Gastroenterology Depts., USUHS, Bethesda, MD

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Electrical and Electronic Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.4	0.4	

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

This project has developed a clinically-useful method (laser Doppler instrument and its theory of operation) for clinical measurements of microcirculatory blood flow, the density of flowing red blood cells (RBCs), and mean RBC velocity. Assistance has been given to the commercialization of this methodology and its application to clinical research. Our clinical studies have been directed toward examining normal and abnormal microvascular dynamics through noninvasive clinical studies of skin and nasal mucosa, and in intra-operative clinical studies of muscle and CNS. Collaboration with USUHS is directed toward developing endoscopic application of this technology. Considerable theoretical work has been directed toward an adequate construct with which to interpret the physical measurements and refining the accuracy of the microcirculatory measurements. We have discovered abnormal microcirculatory patterns and responses in the skin of patients with sickle cell disease, hypertension, certain cardiac circulatory syndromes, diabetes, and skin cancer. The microcirculatory effects of therapy are monitored with this technique, affording a better understanding of the microcirculatory component of these diseases.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER
Z01 RR 10122-09 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
Microcomputer Applications for the NIH Bio-Technology Unit (Pilot Plant)

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

T.R. Clem, Sr.	Electronics Engineer, EEES	BEIP, NCRR
Other Investigators:		
Y. Shiloach	Chief, Bio-Technology Unit	LCDB, NIDDK
J. Hsiao	Design Engineer	Fluor Daniel Greenville, SC

COOPERATING UNITS *(if any)*
LCDB, NIDDK; Fluor Daniel, Inc., Greenville, SC

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Electrical and Electronic Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.25	1.0	0.25

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

The NIH Bio-Technology Unit (Pilot Plant) has various instrumentation needs that have not been previously addressed. This project has been concerned with satisfying these instrumentation needs using modern equipment and low-cost desktop size personal computers (PCs). PCs have been acquired and installed to supply a variety of services, including process control, data acquisition, data analysis, and administrative functions. The instrumentation and process control functions use commercial equipment, as much as possible, and are interfaced using standard I/O connections, such as the IEEE-488 GPIB and the RS-232 Serial I/O ports as well as using direct digital and analog I/O components in the desktop computer.

Using these techniques allows changes in the parameters measured or controlled to be accomplished relatively quickly and easily. Utilizing the computational capabilities of the computer/controller allows initial selection of the operating parameters and dynamic alteration of these parameters as the process continues, thus allowing optimization of yields or detailed study of the process parameters. Adaptive control techniques have been applied to the process and further increases in product yield are being realized.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10146-08 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Prosthetic Urethral Sphincter

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

S. B. Leighton	Mechanical Engineer	BEIP, NCRR
Steven Scoog, M.D	Staff Physician	WRAMC
T. Radebaugh	Senior Staff	BRCM, NIA

COOPERATING UNITS (if any)

BRCM, NIA and DCT, NCI

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Mechanical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
.3	.3	0

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

A number of techniques are used for treating urinary incontinence, including prosthetic sphincters. The present work concerns an entirely intraurethral artificial sphincter that can be implanted without surgery. The valve would be appropriately matched to urethral dimensions, pressures, and flow rates. The prosthetic valve would be potentially useful in cases where a natural valve is either nonopening or nonclosing.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10162-08 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Wound Healing: Biology and Rheology

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

T. L. Talbot, MS	Mechanical Engineer	BEIP, NCRR
J. A. Norton, M.D.	Surgery	SB, NCI
G. Solomon, M.D.	Surgery	SB, NCI
W. DeGraft, M.D.	Radiology	C, DCT

COOPERATING UNITS (if any)

SB, NCI, C, DCT

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.0	1.0	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Preliminary studies have been completed with swine model. These studies involved stamping an indelible grid (10 cm x 10 cm) on the skin of an anesthetized swine, excision of a 1 cm x 10 cm strip of the skin out of the grid area, and approximating the incision edges with silk sutures. Photographs of the grid were taken before excision, after excision, and after suturing. These photographs are being analyzed to determine the impressed strain on the wound closure and eventually relate this information to wound breaking strength (WBS).

Studies based on a rat model that relates biologic and pharmacologic interventions to WBS have been completed. Certain groups were treated pharmacologically during the wound healing process. Significant decrease in WBS was observed in these groups, compared to control groups. Further studies will include the comparison of a tumor-bearing group to control groups.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10184-07 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Physical Chemistry of Biological Macromolecules

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

Marc S. Lewis	Research Chemist	BEIP, NCRR
Arun K. Attri	Visiting Scientist	LCB, NHLBI
Michael R. Bubb	Medical Staff Fellow	LCB, NHLBI
Soo Il Chung	Research Chemist	LCDO, NIDR
Martin Flavin	Scientist Emeritus	NHLBI
Susan Green	Post-doctoral Fellow	Dept. Biochem, JHU
Preston Hensley	Research Scientist	Smith Kline & Beecham
Richard Junghans	Research Associate	MB, NCI
Ravi Kambadur	Visiting Fellow	LB, NCI
Philip D. Ross	Research Chemist	LMB, NIDDK
[illegible]r Stewart	Chief	LSB, NIAMS

COOPERATING UNITS (if any)

LS, NIAMS; LCB, NHLBI; LCDO, NIDR; LB, NCI; MB, NCI; LMB, NIDDK; DPB, CBER, Department of Biochemistry Johns Hopkins University and Smith Kline & Beecham

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Microanalysis

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.6	0.6	

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

The purpose of this project is to study the physical properties of a wide variety of biological macromolecules with the goal of correlating these properties to the structure and function of the macromolecules. The emphasis is on the thermodynamics of the interactions of these macromolecules and on their molecular size and shape. Analytical ultracentrifugation and mathematical modeling are the principal research techniques used.

Studies on actin have been directed toward investigating the mechanisms involved in actin polymerization and the interaction of actin with actobindin. Studies on epidermal transglutaminase have involved characterization of the proenzyme form and study of the mechanism of activation. Studies on yeast arginase have been directed toward studying the reversible homogeneous association of this enzyme and the role of metal ions in controlling this. Studies of various deoxynucleotides have been directed toward investigating the reversible monomer-dimer equilibrium as a function of structure. Studies on a-helical fragments of keratin have been directed toward elucidating their role in keratin filaments. Studies on interleukin-2 receptors have been directed toward an elucidiction of the structure of the molecule. Studies on trypanosomatid proteins and tubulin and microtubules have been directed to an understanding of their interaction.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10204-06 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Cell Handling Studies

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

S.B. Leighton	Mechanical Engineer	BEIP, NCRR
J.A. Berzofsky, M.D.	Senior Staff	DCBD, NCI

COOPERATING UNITS (if any)

DCBD, NCI

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Mechanical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.2	0.2	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

In work on monoclonal antibodies, as well as in other endeavors, it is desirable to be able to isolate individual cells. We are developing an inexpensive device for placing one, and only one cell in each well of a microtitre tray, in culture medium. Thus, the progeny in each well will all be descendents of that single cell, or monoclonal. Our device is an improvement over the existing technique of limiting serial dilution, because each well contains a single cell, while a tray filled by the limiting serial dilution technique will contain many empty wells, and may also contain a few wells that contain two or three cells. The device will be fully automated, requiring minimal operator intervention.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER
Z01 RR 10210-06 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Electronic Patient Monitoring System

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

H.E. Cascio	Electronic Engineer	BEIP, NCRR
Others:		
G. Hemphill	Engineering Technician	BEIP, NCRR
K. Musallam	Head Nurse	NURS, CC
N. Kelly	Administrative Officer	OD, CC

COOPERATING UNITS (if any)
CCOD, ARNS

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Electrical and Electronic Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.35	0.15	0.2

CHECK APPROPRIATE BOX(ES)
☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

An electronic patient monitoring system that alerts the nursing staff when a patient (or patients) is leaving the nursing unit is a welcome aid in the care of Alzheimer's Disease patients and other patients with dementia. The system design is based on a wrist watch size radio transmitter to be worn by the patient. A detector unit, placed at the two exit doors, senses the presence of any patient wearing a transmitter watch. With the detection of a patient's transmitter, a microprocessor based controller locks the exiting door, activates an alarm, and displays the patient's name and location on a computer monitor screen. The personal computer records the time and date for each patient's attempt to leave. These data are then used for statistical analysis. A maximum of eight patients can be monitored at two exit doors.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10213-06 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Vitreous Fluorophotometry Analysis

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

P.M. Bungay	Chemical Engineer	BEIP, NCRR
R.F. Bonner	Biophysicist	BEIP, NCRR
M.S. Roy	Ophthalmologist	CB, NEI
M.J. Podgor	Statistician	BE, NEI

COOPERATING UNITS (if any)

Clinical Branch, NEI; Off. of Biometry & Epidemiology, NEI

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Chemical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.0	1.0	

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Vitreous fluorophotometry (VFP) is a clinical procedure for measuring the spatial distribution of fluorescence along the optical axis in a human subject's vitreous following administration of a fluorescent dye. In this project the clinical instrument is a Fluorotron Master manufactured by Coherent, Palo Alto, CA, and the dye is fluorescein sodium given by intravenous injection. The purpose of the project is to improve the protocols for conducting the measurements, processing the output from the instrument, and analyzing the results from the population of normal subjects and patients.

One disease for which VFP may be useful is diabetes and its associated pathology, diabetic retinopathy. Additional goals for this project are to evaluate VFP for use in 1) screening for early detection, and 2) monitoring for treatment efficacy in diabetes and other pathological conditions.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10214-06 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Photoradiation Therapy

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

P.D. Smith	Physicist	BEIP, NCRR
A. Russo	Section Chief	ROB, NCI
T. Delaney	Sr. Investigator	ROB, NCI
H. Pass	Surgeon	SURG, NCI
W. Sindela	Surgeon	SURG, NCI

COOPERATING UNITS (if any)

ROB, NCI; SURG, NCI

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Electrical and Electronic Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 5.0	PROFESSIONAL: 5.0	OTHER:

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Photodynamic therapy (PDT), which is the interaction of light with hematoporphyrin derivative (HDP, Photofrin II), is in clinical use in several areas of application. Currently, PDT is being used clinically for bronchial obstructions, carcinoma in situ of the bladder, and intraperitoneal and pleural tumors. Animal models were investigated and are being analyzed to assess the potential of using PDT for lung mesothelioma. Specially designed fiber optic probes and introducers were manufactured for all cases, calibrated in terms of irradiance delivered to the tissue. Dosimetry for PDT is complex due to the variable irradiation levels within the tissue, sequestering of HPD, and tissue oxygenation.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10225-06 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Processing of High Resolution Electron Micrographs

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

Michael Unser	Visiting Scientist	BEIP, NCRR
Benes Trus	Research Chemist	CSL, DCRT
Alasdair C. Steven	Visiting Scientist	LPB, NIAMS

COOPERATING UNITS (if any)
CSL, DCRT and LPB, NIDDK

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Office of the Chief

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 1.0	PROFESSIONAL: 1.0	OTHER: 0.0

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

High resolution micrographs are often of poor quality, due to a variety of distortions and, especially, a very low signal-to-noise ratio. For micrographs of quasi-periodic arrays or sets of images of ostensibly identical free-standing particles, visual quality can be improved significantly by using correlation-averaging techniques.

Over the years, we have developed several computational techniques for the statistical analysis of sets of electron micrographs of biological macromolecules. These methods include various types of factorial analyses (correspondence analysis, principal components), an outlier detection scheme, clustering algorithms, as well as a statistical criterion for quantitative assessment of spatial resolution (spectral signal-to-noise ratio).

An aspect that has been considered in more detail is the possibility of improving signal extraction through the use of weighted averaging techniques. In particular, we have developed a new procedure that computes optimal weights by maximizing a global signal-to-noise ratio criterion. By relating our new averaging procedure with the well known principal component decomposition, we have been able to provide an explanation for the striking similarity that can be observed experimentally between the first eigen-image of a data set and the conventional ensemble average.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10238-05 BEI

PERIOD COVERED

October 1, 19890 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Automation of BEIP Information Processing Functions

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

J.R. Ellis	Senior Staff Fellow	BEIP,NCRR
C. Martin	Management Analyst	MAO, NCRR
R.L. Levin	Biomedical Engineer, MES	BEIP, NCRR
M.E. Gavin	Management Assistant	BEIP, NCRR
G. Bladen	Manager, SERP	BEIP, NCRR

COOPERATING UNITS (if any)

MAO, NCRR

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Office of the Chief

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.4	0.2	0.2

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

The computational and accounting resources of BEIP are often inadequate to the demands placed on them. The objectives of this project originally were: to determine the needs of the branch; to identify appropriate resources; and to match resources to changing user demands.

These objectives have evolved with experience to encompass sitting on committees to coordinate statements of our needs with those of other organizations; dealing with the constraints of organizations whose needs must be satisfied, such as DCRT and DFM; and attempting to satisfy local needs with minimal resources while living with the rules, constraints, and directives set by DHHS and other high-level organizations.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	**PROJECT NUMBER** Z01 RR 10240-05 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
Clinical Measurement of Microvascular Blood in Sickle Cell Patients

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

E.C. Walker	Chief, ACES	BEIP, NCRR
G.P. Rodgers	Senior Staff Fellow	LCB, NIDDK
A.N. Schechter	Chief	LCB, NIDDK

COOPERATING UNITS *(if any)*
LCB, NIDDK

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Applied Clinical Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.5	0.5	

CHECK APPROPRIATE BOX(ES)
☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

It is commonly known that sickle cell patients possess red blood cells that have abnormal rheological properties. The cell properties affect bulk vascular flow in general and microvascular flow in particular. Severe manifestations of this disease can be observed acutely, during intensely painful crises, and chronically, as demonstrated by damage to the cardiovascular system and various organs. It is our intention to develop and explore the use of non-invasive instrumentation to study the character and degree of peripheral blood flow in stable sickle cell patients. We are currently using commercial devices to monitor non-invasively several variables. Because the devices we employ are relatively new, we will also develop a reliable means for evaluating them for potential use with our patient population.

Flow studies of this nature can lead to improved understanding of the micro-obstructive component of sickle cell disease as well as serve to evaluate potential therapies such as hydroxyurea.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10252-04 BEI

PERIOD COVERED

October 1989 - September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Physiological Monitoring System for Sepsis Models

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

E. C. Walker	Chief, ACES	BEIP, NCRR
J. A. Norton	Section Chief	SURG, NCI
R. Alexander	Clinical Associate	SURG, NCI

COOPERATING UNITS (if any)

SURG, NCI

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, Maryland 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1	1	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

For studying the role of cachectin/Tumor Necrosis Factor -TNF in septic shock we have developed a physiological monitoring system for laboratory rats. Temperature and direct arterial pressure were monitored.

Special carotid/aortic catheters were designed and tested for frequency response. New catheters are supplied on a continuous basis. During actual studies, septic shock was induced and physiologically characterized.

Current studies center around repetitive administration of recombinant TNF and the effects of rTNF on mortality and morbidity of gram negative sepsis.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10256-04 BE

PERIOD COVERED

October 1, 1989 - September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Mechanical Prosthetic Heart Valve Tester

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

T. L. Talbot	Mechanical Engineer	BEIP, NCRR
F. A. Arabia	Senior Investigator	SB, NHLBI
R. E. Clark	Chief	SB, NHLBI
S. F. C. Stewart	Staff Fellow	SB, NHLBI

COOPERATING UNITS (if any)

Cardiac Surgery Branch, NHLBI

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, Maryland 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
.75	.75	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Six different manufacturers' prosthetic heart valves were tested and ranked according to performance indices described by W. Swanson and S. Gabbay. Additionally, a technique was devised whereby the pressure drop across the aortic valve could be predicted by velocity measurements made with continuous wave Doppler (CWD) imaging. The results of preliminary *in vitro* studies demonstrate a high correlation ($r>0.9$) between the peak velocity as measured with CWD and the predicted velocity obtained by the application of a simplified Bernoulli equation, which uses a measured maximum pressure drop across the aortic valve. Also, an acoustical signature analysis technique is under investigation for possible non-invasive detection of partially-failed single leaflet type mechanical valves.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10257-04 BEI

PERIOD COVERED

October 1, 1989 - September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Analysis of Propagation of Light in Turbid Biological Tissues

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

R. F. Bonner	Physicist	BEIP, NCRR
R. Nossal	Sr. Research Physicist	LPS, DCRT
G. Weiss	Chief	LPS, DCRT
S. Havlin	Visiting Scientist	LPS, DCRT
T. Delaney	Senior Investigator	ROB, NCI
M. Leon	Senior Investigator	CB, NHLBI

COOPERATING UNITS *(if any)*

LPS, DCRT; Department of Physics, Bar-Ilan University, Israel

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Electrical and Electronic Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, Maryland 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.0	1.0	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
 ☐ (a1) Minors
 ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Many of the clinical research projects of the laser biophysics group involve the interaction of light with tissue (e.g., laser microsurgery, laser Doppler blood flow measurements, photodynamic therapy of cancer, noninvasive platelet assessment). In order to quantitate these techniques more fully, we have undertaken theoretical modeling of light propagation in biological tissues and turbid media.

Analytical equations have been devised characterizing various parameters of photons illuminating a tissue surface (including probability of surface re-emission at a given distance, mean path before re-emission, mean depth of penetration, probability of absorption with depth). These expressions have been used to interpret empirical measurements on living tissues and to quantify better a variety of clinical measurements (e.g., laser Doppler blood flow and volume measurements, dosimetry in PDT of cancer, and remote sensing of atherosclerotic plaque.

Recently our theoretical predictions of path length distributions of re-emitted photons have been applied to temporal dispersion of picosecond laser pulses in brain and muscle. Such analysis allows noninvasive, absolute quantitation of hemoglobin and myoglobin oxygen saturation *in-vivo*, as well as the concentration of a variety of important biomolecules.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10258-04 BEI

PERIOD COVERED
October 1, 1989 - September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
Photochemical Inactivation of Virus and Bacteria in Blood

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

R. F. Bonner	Physicist	BEIP, NCRR
K. N. Prodouz	Biologist	DBBP, FDA
J. C. Fratantoni	Section Chief	DBBP, FDA

COOPERATING UNITS *(if any)*
DBBP, FDA; ROB, NCI

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Electrical and Electronic Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, Maryland 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1	1	

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☒ (b) Human tissues ☐ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Photochemical sterilization of blood products is the ultimate goal of this project, in which we are quantitating photochemical destruction of virus in blood and blood products and the effects of the process on the native blood components. Initial studies using an XeCl excimer laser characterized the response of virus and blood components as functions of cumulative fluence and peak irradiance. Single and multiple photon photochemical schemes were investigated. Single photon photochemistry resulted in an efficacious treatment range between 10-20 J/cm^2 in which a hardy virus is inactivated and platelets and plasma proteins are minimally affected. Multiple photon effects at higher irradiance led to increased protein damage in blood components without increasing efficacy of viral inactivation. Augmentation of this therapeutic window by photochemistry using exogenous agents such as riboflavin, tetracycline, and hemocyanin was investigated with a focus on the adverse effects on platelets and the relative susceptibility of different viruses dependent on the complexity of their coat. The inhibitory effect of serum and albumin on photochemistry was also examined. Proposed work will examine exogenous agents which show strong affinity for binding to DNA and thereby might increase therapeutic efficacy. The high sensitivity of blood platelets to activation and/or damage by photochemical products (e.g., singlet oxygen) has led to a renewed emphasis on optical and immunological methods of monitoring minimal lesions associated with viral inactivation photochemistry as well as standard blood banking techniques of preparation and storage.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10259-04 BEI

PERIOD COVERED

October 1, 1989 - September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Visual Target Tracking-Ability Assessment System

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

T. R. Clem, Sr.	EEES	BEIB, DRS
R. Litman, M.D.	CNSB	NIMH
C. Schooler, M.D.	LSES	NIMH
B.R. Roberts	LSES	NIMH

COOPERATING UNITS *(if any)*

CNSB, LPP, NIMH

LAB/BRANCH

Biomedical Engineering and Instrumentation

SECTION

Electrical and Electronic Engineering Section

INSTITUTE AND LOCATION

DRS, National Institutes of Health, Bethesda, Maryland 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1	0.9	0.1

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Abnormal eye movements found in CNS diseases may be related to the underlying pathophysiology of a particular CNS disease. Although the oculomotor nuclei, their descending primary motor neurons, and the extraocular muscles they innervate ultimately mediate eye movements, higher centers, including premotor areas in the brainstem, midbrain, subcortical areas and cerebral cortex, are also involved in the movements. The oculomotor nuclei and neurons, together with the higher motor centers, functionally comprise five oculomotor systems responsible for different types of eye movements. Of these, the smooth pursuit eye movement system and saccadic eye movement system are of interest, for they seem to be abnormal in CNS disorders where disease in higher subcortical and cortical centers is implicated.

Both smooth pursuit and saccadic eye movements have properties that clearly distinguish them and make them easy to measure. Disorders of smooth pursuit eye movements (SPEM) have been found in schizophrenia, as well as other psychiatric disorders characterized by psychotic symptoms. Abnormal SPEM can be found in a variety of CNS illnesses, primarily those that affect the oculomotor nuclei (e.g. brainstem infarction). Abnormal SPEM and abnormalities in saccadic eye movements have also been associated with more diffuse brain diseases such as DAT, Huntington's and Parkinson's Diseases.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER
Z01 RR 10260-04 BEI

PERIOD COVERED
October 1, 1989 - September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Real-Time High-Performance Confocal Laser Scanning Optical Microscope

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

S. Goldstein	Chief, MES	BEIP, NCRR
M. Datiles	Clinical Branch	NEI
T. Smith	LNP	NINDS

COOPERATING UNITS (if any)
Clinical Branch, NEI

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Mechanical Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, Maryland 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.8	0.7	0.1

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

A no-moving-parts, 30 frames per second, laser beam scanning confocal reflected light microscope has been developed. In principle the technique can be extended to fluorescence and transmission light microscopy. Acousto-optic beam deflectors, controlled by all digital electronics, move a laser beam in a 512 line interlaced 8.5mm square raster. The light enters an inverted microscope through the side camera port, and is imaged at the object by the microscope objective. Reflected light returns through the objective, out the camera port, through a beam splitter, and is imaged onto the photocathode of an Image Dissector Tube (IDT). Confocality is provided by raster scanning the IDT aperture coincident with the congruent image of the laser beam incident on the object. Real time jitter-free reflected light images of a variety of biological objects have been produced. Computer controlled alignment of the laser scan and IDT is performed in several seconds.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10267-04 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
A Low-Noise Electrometer for an Automated Hemoglobin Oxygen Equilibrium Curve Measurement System

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

H. E. Cascio	Electr. Eng.	BEIP, NCRR
R. L. Berger	Physicist	LCB, NHLBI
K. O. Kalmbach	Eng. Tech.	LCB, NHLBI

COOPERATING UNITS *(if any)*
LTD, NHLBI

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Electrical and Electronic Engineering.

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, Maryland 20892

TOTAL MAN-YEARS: 0.2	PROFESSIONAL: 0.2	OTHER:

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☒ (b) Human tissues ☐ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Measurement of the hemoglobin oxygen equilibrium curve (OEC) in an automated system is hampered by noise. To obtain reliable results in reading partial pressures with an accuracy of 0.01 mmHg requires special techniques in electronic circuit design. The pO_2, pH, and the pCO_2 electrodes have very high internal resistance with very low output signal levels. When these devices are used in an environment contaminated by radio frequency interference (RFI) from a computer, the magnetic fields of stepping motors, as well as power line transients generated by a high current water bath, the electrode output leads must be kept short and shielded. The electrode signals must be kept scaled and offset by a computer-controlled signal processor that properly interfaces these voltages to an AT-type personal computer, for further software analysis. Another task to be performed is the designing and fabrication of the required circuitry for the development of the automated system to perform the desired measurements.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10270-04 BEI

PERIOD COVERED

October 1, 1989 - September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Computer-Assisted Analysis Echocardiograms

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

M. Unser	Visiting Scientist	BEIP, NCRR
M. Eden	Chief	BEIP, NCRR
G. Pelle	Chargé de Recherche	Unité 138, INSERM
P. Brun	Chief	Unité 138, INSERM

COOPERATING UNITS *(if any)*

Unité 138, INSERM

LAB/BRANCH

Office of the Chief

SECTION

Biomedical Engineering and Instrumentation Program

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	**PROFESSIONAL:**	**OTHER:**
1.0	1.0	

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Echocardiography is a non-invasive method for monitoring ventricular function and evaluating myocardial hypertrophy in patients with heart disease. Computer-assisted image analysis methods are designed to facilitate and standardize the extraction and quantification of anatomical and physiological parameters that are critical for diagnostic purposes.

We have previously developed image processing techniques for the analysis of one-dimensional or M-mode echocardiography, which is widely accepted as the reference method for the evaluation of myocardial wall thickness. These methods address two types of problems in particular: (i) the automated extraction of myocardial borders, and (ii) the restoration of sequences of several consecutive heart beats by performing an average with respect to a normalized time-scale.

More recently, we have extended some of these techniques for the detection of endocardial borders in two-dimensional echocardiograms. An algorithm that we propose is designed to detect boundaries that can be parameterized in polar coordinates. Given the specification of a center point, the image data is recoded in polar coordinates and the border characteristics are enhanced by matched filtering. The final processing step is a border tracking algorithm that uses dynamic programming optimization. Our preliminary results are extremely ,promising and suggest that the method is robust.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10271-03 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Strain Rate Dependency of Wound Breaking Strength

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

T. L. Talbot, M.S.	ACES	BEIP, NCRR
D.T. Cromack, M.D.		NCI, SB
J. A. Norton, M.D.	Chief	NCI, SB

COOPERATING UNITS *(if any)*

Surgery Branch, NCI

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 0.1	**PROFESSIONAL:** 0.1	**OTHER:**

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

This section has been involved in wound healing studies for the past decade. The primary measurement which these studies make is the wound breaking strength of a dermal wound at various stages of the healing process. Multiple modalities and healing interventions have been employed to enhance the healing of normal wounds or to minimize the deleterious effects on healing of chemotherapeutic agents. Currently research in the area is burgeoning as a result of the availability of relatively low cost growth factors synthesized through the employment of recombinant techniques. Unfortunately, cross-study comparisons are difficult to interpret because of the strain rate dependency of the wound breaking strength. The literature has reported extension rates varying from one to thirty centimeters per minute.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10272-03 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Photometry for Photo-Dynamic Therapy

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

W.S. Friauf	Chief, EEES	BEIP, NCRR
Others:		
J. Cole	Elect. Engr.	BEIP, NCRR
P.D. Smith	Physicist	BEIP, NCRR
R.F. Bonner	Biophysicist	BEIP, NCRR
A. Russo	Section Chief	ROB, NCI
T. Delaney	Clinical Assoc.	ROB, NCI
H. Pass	Surgeon	SURG., NCI

COOPERATING UNITS (if any)

ROB, NCI, and SURG, NCI

LAB/BRANCH

Biomedical Engineering and Instrumentation

SECTION

Electrical and Electronic Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.4	0.4	

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Dosimetry for photodynamic therapy (PDT) involves measurement of hematoporphyrin derivative (HPD) concentration, oxygen concentration, singlet oxygen concentration, and therapeutic light level, all as a function of position throughout the tissue being treated intentionally or unavoidably. Non-invasive measurements are essentially limited to surfaces, although theoretical and empirical models can be used to estimate values some distance into the tissue. Fiber optic probes can be used for direct sub-surface measurements.

DEPARTMENT OF HEALTH AND HUMAN SERVICES • PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10273-03 BEI

PERIOD COVERED

October 1, 1989 - September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Continuum Models of the Dynamics of Gels

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

Peter Basser.	Senior Staff Fellow	BEIP, NCRR
Piero Chiarelli, Dott.	Senior Researcher	BEIP, NCRR

COOPERATING UNITS (if any)

Centro "E. Piaggio", University of Pisa, Italy

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Mechanical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 0.2	**PROFESSIONAL:** 0.2	**OTHER:**

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

A hydrogel strip exhibits stress-relaxation when stretched. The decay in tensile stress can be ascribed primarily to strain-induced swelling of the polymer network. This assertion is supported by a bi-phasic continuum model of the gel-solvent system: An equation of motion, a linear constitutive law of the polymer network, Darcy's law and the conservation of mass of the network constituents and interstitial fluid are all solved with boundary and initial conditions appropriate for a stress-relaxation experiment. The model predicts the evolution and distribution of the interstitial fluid pressure, elastic stress, total tensile stress, and isometric force applied to the clamp during the course of a stress-relaxation experiment. It also predicts that the stress-relaxation time constant depends inversely upon the square of the thickness of the gel strip - a non-intuitive result that is confirmed by experiments. The model has recently be extended to explain why crazing or fractures develop in hydrogels during hydration.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10274-03 BEI

PERIOD COVERED

October 1, 1989 - September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

A Non-invasive Method to Measure and Monitor Contact Stress in Tissue

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

Peter Basser	Senior Staff Fellow	BEIP, NCRR
John Eng	Howard Hughes Fellow	LKEM, NIHLB
Bruce Berkowitz	Senior Staff Fellow	LKEM, NIHLB

COOPERATING UNITS (if any)

LKEM/NIHLB; SN/NINCDS

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Mechanical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	**PROFESSIONAL:**	**OTHER:**
0.2	0.2	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Increased interstitial pressure can reduce tissue perfusion and may lead to edema and increase contact stress* between different tissues. A device to measure and monitor contact stress is under development in BEIP. It consists of a flexible bag containing a polyelectrolyte gel and an NMR pH indicator. Normal stress applied to the bag is felt by the spongy gel, squeezing fluid from its interstitium into the surrounding bath. Compression increases the gel's charge density, altering the existing intracellular and extracellular equilibrium pH distribution. The applied stress is inferred from a non-invasive NMR spectroscopic measurement of pH. Since no external connections are required, a sterile field can be maintained. In addition, long-term stability is expected. The sensor contains no cytotoxic substances or non-toxic chemicals in non-physiologic concentrations whose release would also present a threat to the surrounding biological tissue. The stiffness of the gel can be changed by altering its polymer content, allowing the operating range and sensitivity of the sensor to be controlled.

*N.B. Contact pressure is defined as the normal component of the interfacial stress between two bodies in contact with one another; it is not the ambient isotropic normal stress known as hydrostatic pressure.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE NOTICE OF INTRAMURAL RESEARCH PROJECT	PROJECT NUMBER Z01 RR 10276-03 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Microdialysis Probe Studies

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

R.L. Dedrick	Chemical Engineer	BEIP, NCRR
P.F. Morrison	Physical Scientist	BEIP, NCRR
P.M. Bungay	Chemical Engineer	BEIP, NCRR
K.H. Dystra	Chemical Engineer	BEIP, NCRR
J.K. Hsaio	Psychiatrist	LCS, NIMH
I.N. Mefford	Chemist	LCS, NIMH
K.S. Bankiewicz	Neurosurgeon	SNB, NINCDS

COOPERATING UNITS (if any)
Lab. Clinical Science, NIMH; Surgical Neurology Br., NINCDS

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Chemical Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
2.2	2.0	0.2

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Microdialysis probe technology provides access to tissue interstitium for either sampling or delivery of diffusible substances. However, the relationship of the probe perfusate concentrations to their tissue counterparts is a complex function of solute molecular weight, solute physicochemical properties, tissue properties, probe membrane properties, probe geometry and perfusion rate, and the trauma of probe insertion into the tissue. These dependencies will be studied in order to improve the quantitative usefulness of the technology. The focus of applications is the brain in connection with Parkinson's disease and transplant therapy. Solutes of particular interest are dopamine and its metabolites. Approaches considered include mathematical modeling of solute transport within the probe and surrounding medium with both *in vitro* and *in vivo* validation experiments.

DEPARTMENT OF HEALTH AND HUMAN SERVICES • PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10283-03 BEI

PERIOD COVERED

October 1, 1989 - September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

A Micro-Computer Based Flow Cytometry Data Collection and Analysis System

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

C.P. Mudd	Biomedical Engineer	ACES, BEIP, NCRR
J. A. Dvorak	Researcher	LPD, NIAID

COOPERATING UNITS (if any)

LPD, NIAID

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.1	0.1	0.0

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

In order to overcome some of the deficiencies of early generations of microcomputers for data collection from flow cytometers, several of the functions such as analog to digital conversion and data storage in static RAM, have been performed "external" to the computer. In addition, "mixed" flow cytometry systems in which data are collected with a minicomputer and analyzed with a microcomputer have been developed. However, these approaches are not cost effective and do not effectively use the improved capabilities of available microcomputers. With the evolution of the Intel 80XXX family of processors, reliable peripherals, and a variety of powerful compilers, it has become feasible to develop a relatively inexpensive microcomputer-based data collection and analysis system for flow cytometry that performs as well as, or better than, minicomputer-based systems.

Earlier we developed an electronic interface system which linked the analog signals from the four preamplifiers of the flow cytometer to the micro-computer. This system collected, processed, and conditioned the analog signals before acquisition by the micro-computer and effectively solved the problem of interfacing asynchronous and synchronous data conversion, acquisition and storage. We found that when analog signals occurred simultaneously with the reset of the integrators only partial integrations were obtained which skewed the cell histogram. A trigger hold-off circuit in the analog detector section eliminated this problem. The complete system, flow cytometer, interface, and micro-computer, has been in routine laboratory use for almost two years.

During this period, we have studied in detail the timing of the various interface and computer tasks to identify where improvements in data throughput were possible.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10284-03 BEI

PERIOD COVERED

October 1, 1989 - September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Measurement of the Binding Heats of Oxygen to Hemoglobin

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

C.P. Mudd	Biomedical Engineer	ACES, BEIP, NCRR
R.L. Berger	Chemist	LTD, NHLBI

COOPERATING UNITS *(if any)*

LTD, NHLBI

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.1	0.1	0.0

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☒ (b) Human tissues ☐ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

The binding of oxygen to hemoglobin is thought to be a multistep process with different rate constants for each step. With an all tantalum stopped-flow calorimeter developed earlier, we can easily measure the heat of binding of oxygen to hemoglobin. The all-tantalum system will prevent the diffusion of oxygen into the system and will allow us to measure these heats over the entire saturation range, 0-100%; preliminary measurements of the binding heat at 50% saturation are in good agreement with published values.

An in-line spectroscopic flow cell is used to measure the oxygen saturation of the mixed hemoglobin and oxygen to verify the final saturation value. The measurements at lower saturation values, less than 35%, have been made. In order to achieve high saturation values, we needed a solute which could carry more oxygen than an aqueous based solution we used at the lower saturation values. We found a fluorocarbon liquid which can hold 25 times more oxygen than water. It will be used to carry the oxygen for the measurement at higher saturation values.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	**PROJECT NUMBER** Z01 RR 10285-03 BEI

PERIOD COVERED
October 1, 1989 - September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Determination of Binding Enthalpies of Anthracycline Drugs to DNA Host Cells

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

C.P. Mudd	Biomedical Engineer	ACES, BEIP, NCRR
D.P. Remeta	Research Fellow	FDA
K.L. Breslauer	Chemist	Rutgers University

COOPERATING UNITS (if any)
Department of Chemistry, Rutgers University

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Applied Clinical Engineering

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.1	0.1	0.0

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

After performing the first direct measurements of the drug binding enthalpies for daunomysin to DNA in the 10-20 micromolar range (where the monomeric form predominates), we extended the experiment to other anthracycline drugs. We have now studied the salt and temperature dependence of the binding enthalpies for this class of drug. With a tantalum stopped flow microcalorimeter, we were able to measure 120 of these runs per day with an uncertainty of only 3 microjoules.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10286-03 BEI

PERIOD COVERED
October 1, 1989 - September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
High Speed Differential Stopped Flow Calorimeter

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

C.P. Mudd	Biomedical Engineer	ACES, BEIP, NCRR
R.L. Berger	Chemist	LTD, NHLBI

COOPERATING UNITS (if any)
LTD, NHLBI

LAB/BRANCH
Biomedical Engineering and Instrumentation

SECTION
Applied Clinical Engineering

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.1	0.1	0.0

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

A preliminary single channel, high speed, stopped-flow calorimeter has been constructed to evaluate mixing speeds, flow velocities, pressure drops, and thermal detection sensitivity. The system uses a variable speed flywheel and electrically actuated clutch to transfer sufficient energy to the two drive syringes to mix reagent volumes of 200 microliters in 5 milliseconds or less. The inlet tubes from the drive syringes, as well as the mixer and the detection chamber are kept at constant temperature between 25 and 50 deg C. An ultra-fast thermistor (1 ms) is located in the detection chamber to measure the temperature rise during the reaction. A new drive cam is used which produces a constant acceleration of the syringes. The mixing chamber contains a quartz observation tube to allow optical measurement of the reaction. The observation tube 'floats' in o-ring seals to reduce shock loads during mixing.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10289-03 BEI

PERIOD COVERED
October 1, 1989 - September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Tantalum Batch Calorimeter for *In Vitro* Cell Studies

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

C.P. Mudd	Biomedical Engineer	ACES, BEIP, NCRR
R.L. Berger	Chemist	LTD, NHLBI

COOPERATING UNITS (if any)
LTD, NHLBI

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Applied Clinical Engineering

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.1	0.1	0.0

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

In biological experiments, it is often desirable to monitor the heat output of in vitro cell preparations as nutrients, drugs, etc., are added to the preparation. In addition, the measurement of temperature, p02, pC02, and pH is very useful. To meet these needs, we have designed a new type of heat conduction batch calorimeter. The instrument has two, large (5 ml) tantalum cells arranged in a differential configuration. Each cell has provision to accommodate 6, 1 mm O.D. fluid delivery lines or fiber optic sensor lines. The heat production of the cell preparation is detected using a scheme similar to that used in our earlier batch calorimeters. The cell temperature can be set between 4 deg C and 50 deg C.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10296-03 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Experiments with a High Resolution Field-Emission STEM

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

R.D. Leapman	Physical Scientist	BEIP, NCRR
S.B. Andrews	Chemist	LN, NINCDS
J. Hunt	Electronics Engineer	Dept. Material Science, Lehigh University
C.R. Swyt	Physical Scientist	BEIP, NCRR

COOPERATING UNITS *(if any)*

LN, NINCDS; Lehigh University

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Electron Beam Imaging and Microspectroscopy Group

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.8	0.8	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

A VG Microscopes field-emission scanning transmission electron microscope (STEM) has been used to image and analyze rapidly frozen isolated macromolecules. Despite structural degradation due to radiation damage, elemental analysis of metal atoms bound to proteins was achievable at a resolution of ~100Å using parallel-detection electron energy loss spectroscopy (PEELS). Copper was measured in hemocyanin molecules and the four iron atoms in hemoglobin were detectable if very high electron doses were used $(\sim 5\times10^{8}e/\text{Å}^{2})$. Phosphorus was detectable in the tobacco mosaic virus containing a single strand of RNA, suggesting that PEELS could be used to measure the degree of phosphorylation of proteins such as neurofilaments. Elemental mapping was achieved using a digital acquisition system interfaced to the parallel EELS and it was demonstrated that images could be obtained from ferritin molecules giving the iron distribution in these molecules.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10300-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Myocardial Cell Contractility Study

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

T. Talbot	Mechanical Engineer	BEIP, NCRR
C.P. Mudd	Biomedical Engineer	BEIP, NCRR
Joseph Schmitt	Staff Fellow	BEIP, NCRR
G. Krishna	Sr. Investigator	CP, NHLBI

COOPERATING UNITS (if any)

NHLBI, Clinical Pharmacology

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 0.2	PROFESSIONAL: 0.2	OTHER:

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Myocardial cells grown in culture exhibit dramatic visible changes in beating characteristics when they are presented with various types of chemotherapeutic agents. A technique for quantifying these changes is of paramount importance. Because of the fragile nature of these cells in culture the measurement modality must be totally non-invasive.

A video tracking system currently used to quantify the myocardial depressant effects of septic serum on rat neonate myocardial cell cultures will be adapted to this experimental setup. This system can measure the displacement of an individual cell as it beats. We intend to enhance this system by measuring the first and second derivatives, which will yield the velocity and acceleration of the beating cell. It is hoped that the acceleration can be incorporated into an estimate of the force of contraction.

This project is complete. The device as described above was modified and delivered to the senior investigator. The device is functioning well and experiments are underway that we anticipate will provide further understanding of myocardial contractility.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10301-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Particle Size Distributions of Nebulized Drugs

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

E.C. Walker	Chief, ACES	BEIP, NCRR
A. Rich	Mechanical Engineer	BEIP, NCRR
R.C. Hubbard, MD	Senior Investigator	PB, NHLBI

COOPERATING UNITS *(if any)*

PB, NHLBI

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
.10	.10	

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Recombinant alpha 1-antitrypsin is currently administered intravenously in the treatment of cystic fibrosis. A new protocol has been designed to treat patients with this condition via aerosol so as to deliver large doses of alpha-1 antitrypsin directly to the respiratory tract.

We will study the particle size distributions of several nebulizers to ensure that the proper particle size (1-3 microns) is being delivered to the patient.

The Malvern particle sizer (Model 2600C, Malvern Inc., South Borough, MA) was purchased and used to perform several preliminary studies. The Misty, Retec, Vortran, Ultravant and Pari-Boy nebulizers were evaluated. Further studies will involve a more in-depth analysis of the drugs and nebulizers. Some of the nebulizers were found to consistently produce particles in the range for aerosol administration.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10302-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Calibration System for Electronic or Automated Sphygmomanometers

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

E.C. Walker	Chief, ACES	BEIP, NCRR
T. Carson	Technician	BEIP, NCRR
R. Corsey	Electronic Engineer	BEIP, NCRR

COOPERATING UNITS *(if any)*

Clinical Center

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
.1	.1	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Current hospital accreditation standards require performance evaluation of hospital equipment. Although certain performance aspects of electronic sphygmomanometers can be evaluated, a standardized complete evaluation is not commercially available.

We are currently developing a system to simulate a subject during the blood pressure measurement cycle. This system will serve as a standard "patient" for the evaluation of electronic sphygmomanometers. In practice, a user will be able to interface an electronic sphygmomanometer to the calibrator and select the values, such as blood pressure and heart rate, at which the sphygmomanometer is to be tested. At the conclusion of the test a summary report will be provided.

A prototype system has been fabricated and evaluated. Results show that the system is effective, but some modifications should be incorporated in a second prototype.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10303-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Assessment of Scratching in Biliary Cirrhosis Patients

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

T. Talbot	Mechanical Engineer	BEIP, NCRR
J. Schmitt	Staff Fellow	BEIP, NCRR
E. Walker	Section Chief	BEIP, NCRR
N. Bergasa	Medical Staff Fellow	LDS, NIDDK
E. Jones	Senior Investigator	LDS, NIDDK

COOPERATING UNITS *(if any)*

NIDDK, Liver Unit

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.0	1.0	

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Patients with the disease primary biliary cirrhosis suffer from severe bouts of itching, manifested clinically by chronic scratching. In order to evaluate the efficacy of experimental drugs that may relieve the itching, it is necessary to quantify the scratching. A piezoelectric foil cemented to the patient's primary scratching fingernail will transduce mechanical vibrations generated by the scratching to a miniature FM transmitter. After the signal is obtained with a FM receiver, it will be processed by a custom-designed frequency counter, which in turn is interrogated and reset periodically by a personal computer. The study will consist of measurement periods of six to eight hours both before treatment and after treatment with specific drugs. Each patient will serve as his or her own control.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER
Z01 RR 10305-02 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
CC Image Management System

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

R.L. Levin	Biomedical Engineer	BEIP, NCRR
E. Lamoreaux	Computer Scientist	ROB, NCI
J. Foy	Asst. Chief	MIS, CC
T. Lewis	Chief	MIS, CC

COOPERATING UNITS *(if any)*
Radiation Oncology Branch/NCI; Medical Infor. System Dept./CC

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Mechanical Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 0.2	**PROFESSIONAL:** 0.2	**OTHER:**

CHECK APPROPRIATE BOX(ES)
☐ **(a) Human subjects** ☐ **(b) Human tissues** ☐ **(c) Neither**
☐ **(a1) Minors**
☐ **(a2) Interviews**

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

In order to facilitate the viewing and analysis of biomedical images, the Clinical Center is in the process of designing and developing an Image Management System (IMS) to complement the current text-based Medical Information System (MIS). This new system will consist of the following four key components: (1) several different types of medical image gateways (MIG), (2) an image archival and retrieval system (IARS) that has a MIS interface, (3) several different types of workstations (WS) possessing a common biomedical shell, and (4) an interconnecting communications network. The MIGs will permit digital radiological images (i.e. MR, CT, PET, etc.), non-digital radiological images (i.e. plane-film X-ray), and non-radiological images (i.e. video-microscopic images, EKG tracings, patient monitor information etc.) to be converted to a common format, compressed in a loss-less manner, and automatically sent to the IARS. The IARS will permit not only the long term archiving on optical media of the images coming from the MIGs but also the retrieval of multiple modality images to local workstations in response to queries via the existing MIS data-base, the new IMS data-base, or individual departmental data-bases. In the workstation area, we will be developing two or three different types of biomedical workstations. The key to this series of workstations is that they would utilize the same biomedical shell (i.e. user interface). Application programs for diagnostic imaging, stereotaxic surgical planning, radiation therapy planning, tumor staging, etc. will also be developed.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10306-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Liposome Photolysis and Antibody Carriers for Targeted Drug Delivery

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

P.D. Smith	Physicist	BEIP, NCRR
C. Black	Biochemist	ROB, NCI
H. Pass	Surgeon	SB, NCI

COOPERATING UNITS *(if any)*

ROB, NCI; SB, NCI

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Electronic and Electrical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.5	0.4	0.1

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

The ability to selectively deliver a drug to a specific site is a requirement in many clinical situations. One potential vehicle for this are liposomes which can be made to incorporate the drug. This study examines the prospects of being able to release the drug by lysis following photo-excitation of a dye incorporated into the liposome wall. Several compositions of the liposome preparation have been evaluated each including phthalocyanine which is excited at 670nm.

A second approach is to use an antibody, targeted for a specific site or tissue mass, with a desired drug attached. The potential, with anti-tumor antibodies, is to improve the selectivity of photodynamic cancer therapy, and secondarily, to increase tissue penetrance both of which reduce the clinical effectiveness of this therapeutic modality.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10307-02 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Pulse Oximeter Calibrator

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

J.M. Schmitt	Staff Fellow	BEIP, NCRR
G.X. Zhou	Visiting Scientist	BEIP, NCRR
E.C. Walker	Section Chief, ACES	BEIP, NCRR

COOPERATING UNITS (if any)

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Applied Clinical Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.2	0.1	0.1

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Although the clinical application of pulse oximetry has become widespread since the early 1980's, a convenient method for testing the operation and accuracy of commercial pulse oximeters does not yet exist. Our work has been directed toward the development of a calibrator that employs a liquid-crystal light valve to simulate the optical signals measured by pulse oximeters. The feasibility of our calibration method has been demonstrated using a prototype device constructed in our laboratory.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10308-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Reflectance-Mode Pulse Oximetry

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

J.M. Schmitt	Staff Fellow	BEIP, NCRR
G.X. Zhou	Visiting Scientist	BEIP, NCRR
E.C. Walker	Section Chief, ACES	BEIP, NCRR
R.T. Wall	Chief, Anesthesia Dept.	ANESTH, CC

COOPERATING UNITS (if any)

ANESTH, CC

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.5	0.4	0.1

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Although pulse oximeters have been used extensively over the last few years in all major hospitals, the theoretical basis of pulse oximetry is still poorly understood. As a result, the development of instrumentation has relied on the slow acquisition of empirical knowledge. Recently, clinicians have expressed interest in the possibility of developing a transcutaneous oximeter that operates in the reflection mode, rather than in the transmission mode. Such a device could be used at many sites on the body, and may enable monitoring during shock and other conditions during which peripheral blood flow is compromised.

Our efforts have been focused on improving the theoretical understanding of pulse oximetry. We have developed photon-diffusion models of the skin to study the effect of tissue blood volume and other important variables on the calibration of transmission - and reflection-mode oximeters. Measurements on tissue phantoms and intact skin have been made to confirm the validity of the models.

Guided by the model results, we have constructed solid-state reflectance sensors which can be placed on the forehead, face, and chest to obtain measurements of arterial oxygen saturation.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10309-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Signal Conditioning and Data Acquisition System for Sleep Deprivation Studies

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

C.P. Mudd	Biomedical Engineer	BEIP, NCRR
C.A. Everson	Research Fellow	CPB, NIMH

COOPERATING UNITS (if any)

CPB, NIMH

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.2	0.2	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Current studies into sleep disorders involve the simultaneous measurement of a combination of physical parameters. These include EEG, EMG, heart rate, core temperature, and brain temperature. CPB (Clinical Psycho- Biology) is presently investigating sleep disorders using animal models. Rats display sleep behavior similar to humans and are used in this investigation.

A signal interface system has been designed which processes thermistor inputs as well as RF transmitted temperature signals. A microcomputer is used to linearize and calibrate the temperature signals. With the use of factory calibrated thermistors, the software converts the measured signals directly into degrees Centigrade for storage and display. Two Metrabyte A/D cards are run in background mode to acquire 16 channels of 'fast' signals (EEG's, EMG's etc.) and 16 channels of 'slow' signals (temperature and heart rate). We use the timers on the Metrabyte cards to synchronize the two cards and yet still operate them at different sampling rates.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10310-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Microcalorimeter Measurements of DNA-Protein Interactions

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

C.P. Mudd	Biomedical Engineer	BEIP, NCRR
P.D. Ross	Physical Chemist	LMB, NIDDK
V. Tekeda	Research Chemist	FCRF, NCI
R.L. Berger	Research Chemist	LTD, NHLBI

COOPERATING UNITS (if any)

LMB, NIDDK; FCRF, NCI; LTD, NHLBI

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.1	0.1	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

The use of various proteins to modify the human immune system response is of intense interest in the areas of organ transplants, AIDS, and chemotherapy. At the NCI, several new proteins have been developed for this purpose. At present, these proteins are available only in small amounts (approximately 1 ml). By mixing these proteins with carefully constructed molecules of DNA and measuring the enthalpy, the protein-DNA bond interactions can be determined. Investigators at the NCI and NIDDK consulted BEIB and LTD in regards to measuring the heats of these small samples. We recommended using our tantalum stopped flow microcalorimeter which has the capability of measuring heats of 10 microjoules or less in 80 microliter samples. The first experiments showed that we could measure heats in the range of 5 microjoules with a standard error of less than 0.5 microjoules. We have now completed the preliminary study of this protein with two different DNA hosts at 25 and 37 degrees Centigrade. With the tantalum stopped flow microcalorimeter, we were able to measure a binding heat different when one base pair on the DNA host was changed. Results show that the enthalpy is very low which indicates that the binding is almost exclusively entropy driven.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10313-02 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
High Speed Multi-Channel Spectrophotometer

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

W.S. Friauf	Chief, EEES	BEIP, NCRR
P.D. Smith	Physicist	BEIP, NCRR
R.W. Hendler	Section Chief	LC, NHLBI
J. Cole	Electrical Engineer	BEIP, NCRR
H. Frederickson	Programmer	CSL, DCRT

COOPERATING UNITS *(if any)*
Laboratory of Cell Biology, NHLBI; CSL/DCRT

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Electrical and Electronic Engineering

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.6	0.6	

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

A number of commercial multichannel spectrophotometers using charge-coupled devices have been developed recently for general use in biomedical research. We have explored the possibility of improving both the speed and accuracy of such instruments by exploiting other new devices.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10314-02 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
Pulsed Photo-Dynamic Therapy

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

W.S. Friauf	Chief, EEES	BEIP, NCRR
J. Cole	Electrical Engineer	BEIP, NCRR
A. Russo	Section Chief	ROB, NCI

COOPERATING UNITS *(if any)*
Radiation Oncology Branch, NCI

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Electrical and Electronic Engineering

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.2	0.2	

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Experimental evidence indicates that the efficacy of photodynamic therapy (PDT) is temperature dependent. This opens the possibility of using a temperature gradient in the tissue to partially compensate for the rapid attenuation of light, thus allowing effective treatment to a greater depth. By pulsing the surface temperature at an appropriate rate and illuminating only during the cool phase, the treatment at a selected depth will occur during the warm phase due to the propagation delay experienced by the temperature wave.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	**PROJECT NUMBER** Z01 RR 10315-02 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
A Model of Magnetic Stimulation of a Nerve Fiber

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

B.J. Roth	Staff Fellow	BEIP, NCRR
P. Basser	Staff Fellow	BEIP, NCRR
L.G. Cohen	Visiting Associate	MNB, NINDS
M. Hallett	Clinical Director	MNB, NINDS

COOPERATING UNITS *(if any)*
Medical Neurology Branch, NINDS

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Mechanical Engineering

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.5	0.5	

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

A model is presented to explain the physics of nerve stimulation by electromagnetic induction. Maxwell's equations predict the induced electric field distribution that is produced when a capacitor is discharged through a stimulating coil. A non-linear cable model, containing active Hodgkin-Huxley elements, describes the response of the nerve fiber to this induced electric field. It is shown that the nerve fiber is stimulated by the gradient of the component of the induced electric field that is parallel to the fiber, which hyperpolarizes or depolarizes the membrane and may stimulate an action potential. Once the coil's position, orientation and shape are given and the resistance, capacitance and initial voltage of the stimulating coil are specified, this model predicts the resulting transmembrane potential of the fiber as a function of distance and time. Finally, it predicts complicated dynamics such as action potential annihilation and dispersion.

DEPARTMENT OF HEALTH AND HUMAN SERVICES · PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10316-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Calculation of Electric Fields During Magnetic Stimulation

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

B.J. Roth	Staff Fellow	BEIP, NCRR
W.S. Friauf	Section Chief	BEIP, NCRR
J. Saypol	Guest Researcher	BEIP, NCRR
L.G. Cohen	Visiting Associate	MNB, NINDS
M. Hallett	Clinical Director	MNB, NINDS

COOPERATING UNITS (if any)

Medical Neurology Branch, NINDS

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Mechanical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.6	0.6	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Magnetic stimulation is a new technique for activating neurons that is both painless and noninvasive. Stimulation occurs when a brief current pulse is passed through a coil placed near the neuron, producing an electric field by electromagnetic induction. The goal of this project is to develop mathematical models to calculate the electric field induced in the human body during magnetic stimulation. Two models are developed in detail: 1) a model of the stimulation of a peripheral nerve in the arm, and 2) a model of the stimulation of the brain.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10317-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

New Algorithms for Biomedical Image Processing

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

Michael Unser	Visiting Scientist	BEIP, NCRR
Akram Aldroubi	Staff Fellow	BEIP, NCRR
Murray Eden	Chief	BEIP, NCRR

COOPERATING UNITS (if any)

None

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Office of the Chief

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1	1	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Textural information can play an important role in interpretation of a variety of biomedical images, such as X-rays and ultrasound recordings. We have developed a texture segmentation method using texture features obtained from a combination of spatial filters and non-linear operators. A statistical analysis has been conducted to determine the optimal combination of non-linearities. We found that the combination of transformations $f(x)=|x|^2$ and $g(x)=\log(x)$ maximizes texture discrimination and results in a description with variances approximately constant for all feature components and texture types.

We have also investigated new approaches for noise reduction and edge detection in images such as high resolution electron micrographs and ultrasound recordings. We have defined a family of discrete regularization lowpass filters (R-filters) with an adjustable scale parameter. We have shown that these filters can be implemented very efficiently through successive causal and anti-causal recursive filtering. As an application, we propose a very efficient implementation (8 multiplications + 10 additions per pixel) of the optimal Canny edge detector based on the use of a separable 2nd order R-filter. This latter technique is especially suited for dealing with high levels of noise, a condition that is frequently encountered in biomedical applications.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	**PROJECT NUMBER** Z01 RR 10318-02 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
Apple Macintosh II Based Image Processing Workstation

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

Michael Unser	Visiting Scientist	BEIP, NCRR

COOPERATING UNITS *(if any)*
None

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Office of the Chief

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
.25	.25	

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Until very recently, the integration of image processing systems required considerable expense for the acquisition of specialized hardware, in addition to a major programming effort. As a consequence, image processing has been accessible only to a minority of privileged researchers. With the recent advent of powerful personal computers such as the Macintosh II, this situation is bound to change dramatically. Although such computers offer low-cost hardware configurations for simple image processing tasks, their programming using conventional techniques is notoriously difficult, due to the high level of sophistication of the user interface.

The main purpose of this project was to devise powerful development tools to facilitate the development of specialized image processing software for such workstations. The first step was to create a simple image processing shell which is extremely easy to modify for creating specialized applications; the main feature is that all complex interactions with the user interface are handled automatically and that the programmer need only be concerned with the application-specific procedures. The second aspect was to develop a comprehensive set of basic image processing modules. At present, our software library includes about 200 FORTRAN subroutines that perform image processing tasks such as filtering, edge detection, point transformations, and binary operations.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10319-02 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
Calculation of Electrical Activity in Thick Strands of Cardiac Tissue

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

B.J. Roth	Staff Fellow, MES	BEIP, NCRR

COOPERATING UNITS *(if any)*
None

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Mechanical Engineering

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.1	0.1	

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

A numerical simulation has been performed of the propagation of an action potential through a thick cylindrical strand of cardiac tissue. The bidomain model was used to account for the effect of tissue anisotropy and the interstitial space on current flow, and the Beeler-Reuter model was used for the electrically active membrane properties. A relaxation technique was used to solve the nonlinear partial differential equations. The simulation predicts: 1) the shape of the wavefront across the strand cross-section, 2) the dependence of the conduction velocity on the strand radius and on the radii of the individual cells, 3) the length constant of the tissue, as measured by subthreshold cable analysis, and how it is affected by tissue anisotropy, and 4) the effect of tissue edema (changes in the volume fraction of the extracellular space) on propagation.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10320-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Computerized Methods for Analyzing Two-Dimensional Agarose Gel Electrophoretograms

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

A. Aldroubi	Staff Fellow	BEIP, NCRR
M. Unser	Visiting Scientist	BEIP, NCRR
D. Tietz	Visiting Scientist	LTPB, NICHHD
B. Trus	Research Chemist	CSL, DCRT
A. Chrambach	Senior Staff	LTPB, NICHHD

COOPERATING UNITS (if any)

NICHHD, DCRT

LAB/BRANCH

Biomedical Engineering and Instrumentation Branch

SECTION

Office of the Chief

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
	0	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Previous methods to interpret zonal or polydisperse gel patterns of two-dimensional Serwer-type gels for the size and free mobility (surface net charge density) of each component could not simultaneously measure the abundance of the components. Our work advances the method by specifying the relative concentration of each component on the basis of the densitometric analysis of the pattern. We have established suitable procedures and their underlying algorithms. We have implemented the mathematical routines in a user-friendly software package for use on a personal computer.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10322-02 BEI

PERIOD COVERED

October 1, 1989 to September 20, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Data Acquisition System for an Ultrahigh Resolution Dedicated STEM.

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

C.R. Swyt	Physical Scientist	BEIP, NCRR
C.E. Fiori	Physical Scientist	CAC, NIST
R.L. Myklebust	Physical Scientist	CAC, NIST

COOPERATING UNITS (if any)

CAC, NIST

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Electron Beam Imaging and Microspectroscopy Group, Office of the Chief

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
3.0	3.0	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

An automated data acquisition system for the Vacuum Generators HB 501 ultrahigh-resolution dedicated scanning transmission electron microscope is being developed. The new analytical capabilities of this class of electron microscope require fresh approaches to computerization of data acquisition and analysis. Available commercial systems have been limited in both the kinds of data that can be acquired concurrently and the algorithms for processing the data. A data acquisition and analysis program is therefore under development for the Macintosh II and higher class of computers. The data acquisition will be accomplished utilizing specially modified commercial plug-in bus cards and control software routines interfaced to the program.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10324-02 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
In Vitro Hemodynamic Models for Cardiovascular Studies

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

R.J. Lutz	BEIP, NCRR
T. Jones	BEIP, NCRR
J. Peacock	NHLBI, IR, CB
B. Zunkler	NINCDS, IR, SN
E. Oldfield	NINCDS, IR, SN
H. DeVroom	NINCDS, IR, SN

COOPERATING UNITS (if any)
NHLBI, IR, CB; NINCDS, IR, SN

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Chemical Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
4.0	3.0	1.0

CHECK APPROPRIATE BOX(ES)
☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Physical models of vascular systems are being used to study: (1) hemodynamic flow in coronary arteries; and (2) intracarotid infusions of methotrexate following blood-brain barrier disruption with hypertonic mannitol. (1) The onset of turbulence during oscillating flow has been studied in a series of straight, rigid tubes. An empircal correlation was developed that would predict the transition from laminar to turbulent flow as a function of the peak flow (Reynolds number), the frequency of oscillation (Womersley parameter), and the stroke volume (Strouhal number). Similar experiments were performed with branched tubes, and turbulence correlations were also derived for this situation. (2) Blood-brain barrier disruption (BBBD) was conducted on human subjects with malignant brain tumors using thirty second infusions of hypertonic mannitol. The disruption, designed to increase drug permeability in the tumor, was immediately followed by diastolically-phased pulsed (DPP) infusions of methotrexate (MTX). Also, pre- and post-disruption permeability was assessed in normal brain tissue and in tumor by mesuring uptake of Rubidium (Rb) using PET. Prelimiary analysis of the results to date indicate a transient increase in tumor permeability of approximately 50% that lasts for 15 minutes, and a three fold increase in permeability in surrounding normal brain tissue of comparable duration.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10325-02 BE

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Noninvasive Magnetic Measurement of Current in Peripheral Nerve

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

B. Roth	Staff Fellow	BEIP, NCRR
S. Sato	Neurologist	MNB, NINDS

COOPERATING UNITS *(if any)*

Medical Neurology Branch, NINDS

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Mechanical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 0.25	**PROFESSIONAL:** 0.25	**OTHER:**

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

The magnetic field and electric potential produced by action currents in a human median nerve have been measured in normal volunteers. A mathematical model has been developed relating the measured magnetic field to the current distribution. The project is aimed at developing a noninvasive technique to monitor peripheral nerve regeneration in patients who have suffered localized nerve damage.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10327-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Mass Mapping of Macromolecular Assemblies

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

R.D. Leapman	Physical Scientist	BEIP, NCRR
S.B. Andrews	Chemist	LN, NINDS
T.S. Reese	Chief	LN, NINDS
A.C. Steven	Chief	LSB, NIAMS
F. Booy	Visiting Scientist	LSB, NIAMS
J. Hunt	Electronics Engineer	Lehigh University

COOPERATING UNITS *(if any)*

LSB, NIAMS; LN, NINCDS; Lehigh University

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Electron Beam Imaging and Microspectroscopy Group

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 0.8	PROFESSIONAL: 0.8	OTHER:

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

A system has been developed to measure the molecular weights of macromolecular assemblies using low-dose, dark-field, high resolution scanning transmission electron microscopy (STEM). Mass maps were obtained from a number of test samples including tobacco mosaic virus and limpet hemocyanin. Measurements were also made on brain microtubules and on the microtubule-associated protein, kinesin ATP-ase, the motor protein for anterograde axonal transport.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10329-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Optimized Mammography Instrument

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

A. Eidsath	Staff Fellow, MES	BEIP, NCRR
R. Jennings	Research Scientist	FDA
J. Vucich	Clinical Radiology	NIH

COOPERATING UNITS (if any)

National Center for Devices and Radiological Health, FDA

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Mechanical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	**PROFESSIONAL:**	**OTHER:**
0.9	0.9	

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Mammography plays a vital part in the early detection of breast cancer. Unfortunately, mammography units being used today have never been analyzed from a systems point of view. Multiparameter optimization studies of a mammography system have been reported by Muntz et al (Med. Phys **12**, 5, 1985) in which the patient dose has been minimized, while maintaining satisfactory image quality. The most important new feature of the design is the presence of an array of thin metal vanes arranged in an arc about the x-ray source, between the breast and the film. The vanes absorb scattered radiation and thus improve the quality of the image. In order for the vanes not to image on the film the grid must move in a precisely controlled profile during the exposure.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10330-02 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Kinetics of Erythrocyte Sickling in Physiological Conditions

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

A. Eidsath	Staff Fellow, MES	BEIP, NCRR
W. Eaton	Acting Chief. LCP	LCP, NIDDKD
J. Hofrichter	Senior Staff	LCP, NIDDKD

COOPERATING UNITS (if any)

Laboratory of Chemical Physics, NIDDKD

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Mechanical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 0.1	PROFESSIONAL: 0.1	OTHER:

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☒ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

We are using a flow cell in which the partial pressure of oxygen can be varied rapidly in order to study sickling under conditions that more resemble physiological conditions than have been used in the past. Since there is a broad distribution in the cellular hemoglobin concentration, many cells need to be analyzed simultaneously. The change in shape of the cells in the flow cell is observed under a microscope. A video camera transmits the picture to a computer, where the fraction of cells that have sickled can be automatically determined using image analysis algorithms.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10331-01 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Microanalysis of Rapidly-Frozen Tissue in the Field-Emission STEM

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

R.D. Leapman	Physical Scientist	BEIP, NCRR
S.B. Andrews	Chemist	LN, NINDS
T.S. Reese	Chief	LN, NINDS
C.R. Swyt	Physical Scientist	BEIP, NCRR
B. Ciliax	NRC Fellow	BEIP, NCRR
D.M.D. Landis	Neurobiologist	Case Western Reserve University
I. Atwater	Biophysicist	LCBG, NIDDK

COOPERATING UNITS *(if any)*

LN, NINCDS; LCBG, NIDDK

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Electron Beam Imaging and Microspectroscopy Group

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.4	0.4	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Measurements on thin hydrated cryosections show that x-ray microanalysis is limited to areas greater than 1μm^2 and to the major elements because of radiation damage; the maximum allowed doses are only approximately 10^4 e/nm^2 for analysis of hydrated sections. For freeze-dried cryosections low-dose STEM micrographs show good structural preservation down to the level of single membranes. The small probe size and high stability of the low temperature stage in the HB501 STEM facilitates high resolution analysis of 10-nm scale structures in such sections, although certain detail is lost on irradiation. The sensitivity for microanalysis of elements such as calcium in small organelles is in the range of a few tens of atoms.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	**PROJECT NUMBER** Z01 RR 10332-01 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Characterization of Fluorine-Labelled Compounds by Parallel EELS

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

R.D. Leapman	Physical Scientist	BEIP, NCRR
B. Ciliax	NRC Fellow	BEIP, NCRR
K.L. Kirk	Chemist	LC, NIDDK

COOPERATING UNITS (if any)
LC, NIDDK

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Electron Beam Imaging and Microspectroscopy Group

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 0.4	**PROFESSIONAL:** 0.4	**OTHER:**

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Radiation damage measurements have been made, as a function of temperature and electron dose, on a series of fluorinated organic compounds with fluorine in different chemical environments, F bound directly to a benzene ring, and F or CF_3 on an aliphatic chain. Electron energy loss spectra were obtained using a field-emission STEM and parallel-detection spectrometer and were quantitated to determine mass loss of fluorine and other elements. Fluorine attached directly to a ring was found to be very stable. Trifluoro-methyl on a ring was very unstable at room temperature but stable at liquid nitrogen temperature, whereas trifluoro-methyl on an aliphatic chain was relatively stable even at room temperature. In addition to measurement of fluorine loss changes in chemical bonding were also monitored by recording the near-edge fine structure.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10333-01 BEI

PERIOD COVERED

October 1, 1989 - September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Applications of Artificial Neural Networks in Biomedical Image Processing

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

J.M. Schmitt	Staff Fellow	BEIP, NCRR
A. Markowitz	Electronic Engineer	BEIP, NCRR
M. Green	Physicist	CC, NM

COOPERATING UNITS (if any)

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.2	0.2	0.0

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

SUMMARY OF WORK: Using an approach inspired by biological neural networks underlying the pre-processing stages of the mammalian visual system, we are developing computer processing paradigms for edge detection and image segmentation. Simulations are carried out on a network of interconnected "neurons" to which pixel intensities associated with a 2-D image serve as inputs. The final activation state of the network represents the outlines of contrast features within the image. We intend to apply the image processing techniques developed in this work to the analysis of nuclear medical images.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER
Z01 RR 10334-01 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Applications of Synthetic Membranes to Biomedical Research

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

P.M. Bungay	Chemical Engineer	BEIP, NCRR
J.I. Peterson	Chemist	BEIP, NCRR
R.L. Dedrick	Chemical Engineer	BEIP, NCRR
S.P. Markey	Chemist	LCS, NIMH
R. Milne	Chemist	LCS, NIMH
J.F. Fenstermacher	Physiologist	SUNY-Stony Brook

COOPERATING UNITS (if any)
Laboratory of Clinical Science,NIMH;Department of Neurological Surgery, SUNY-Stony Brook

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Chemical Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.0	0.5	0.5

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

This report concerns development projects which utilize synthetic membrane technology in support of biomedical research. One such project utilizes hydrophilic microporous membranes to achieve continuous *ex vivo* plasmapheresis for sampling blood plasma from an arteriovenous shunt of an animal. This sampling technique is useful in unsteady-state pharmacokinetic experiments requiring the time integral of the plasma free concentration of a chemical species whose distribution between plasma and the formed elements of the blood is in disequilibrium. A second project utilizes reverse osmosis or hydrophobic microporous membranes in hollow fiber configurations to concentrate an aqueous stream to be fed into a mass spectrometer. In the reverse osmosis concentrator water is driven from the feed stream by a transmembrane pressure difference, whereas the second type of concentrator uses heat to drive the water from the feed stream by evaporation through the membrane pores.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10335-01 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Design and Implementation of an Equipment Management Program

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

E.C. Walker	Chief, ACES	BEIP, NCRR
T.L. Talbot	Mechanical Engineer	BEIP, NCRR
R. Corsey	Electronics Engineer	BEIP, NCRR
J. Bucolo	Electronics Tech.	BEIP, NCRR
D.L. Cirelli	Assistant Hosp. Admin.	OD, CC
L. Eldridge	Deputy Exec. Officer	OD, CC

COOPERATING UNITS (if any)

Clinical Center, OD

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering, CCIS

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.75	1.75	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

In collaboration with the Clinical Center, ACES/CCIS is jointly developing an equipment management program to enhance clinical research and patient care by providing a comprehensive program for the management of clinical and non-clinical electrical equipment. The overall goal of the program is to assure the safety and performance of clinical equipment, to assure compliance with federal, JCAHO and other safety/performance standards, to maximize availability of equipment to designated patient care areas, and to manage costs. The Equipment Management Program will be administered by the Clinical Center and involves policies and procedures affecting ACES (safety, standardization), CCIS (maintenance, inventory management and pre-purchase planning) and all Clinical Center/Institute clinical equipment users. Specific policies and procedures are being developed to address inventory control; equipment repair; periodic inspections; preventive maintenance; pre-purchase planning; user education; equipment distribution, storage and disposal; recalls; incident reporting and alerts. A comprehensive manual will serve to document all policies and procedures pertaining to equipment management. A computer-based inventory management system is currently being implemented.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER
Z01 RR 10336-01 BEI

PERIOD COVERED
October 1, 1989 - September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Kinetics of Folate Metabolism

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

P.F. Morrison	Physical Scientist	BEIP, NCRR
C.J. Allegra	Physician	MB, NCI
J. Girard	Analytical Chemist	Amer.Univ.

COOPERATING UNITS (if any)
MB-NCI

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Chemical Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 0.1	PROFESSIONAL: 0.1	OTHER: 0.0

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

A. Leucovorin Biochemistry: Leucovorin is known to potentiate the activity of 5-fluorouracil (5-FU) in the treatment of colon cancer, elevating 5-FU from a compound of little activity against colon tumors when given alone to one of substantial efficacy when given in combination. However, the order of drug administration is critical--giving 5-FU first results in an ineffective protocol. While biochemical hypotheses have been advanced to explain this effect, they have not been shown to be consistent with the known enzyme chemistry of the folate cycle. Thus leucovorin chemistry is being added to our previously published model of the folate cycle in human cancer cells. The mode will be used to test the particular hypothesis that leucovorin is converted to other folate forms sufficiently fast to cause an expanded methylene tetrahydrofolate pool capable of enhancing ternary complex formation with tymidylate synthase and 5-FU.

B. Folate Separations: Because it has proved very difficult to separate higher chain-length folate polyglutamates by high performance liquid chromatography, attempts to separate these compounds by supercritical chromatography have been initiated. Folic and dihydrofolic acids and derivatives have been selected for trial separation. Recently, a potential supercritical solvent containing an amine as a solubilizing agent has been identified composed of CO2 as the major component together with methanol (a few percent) and methylamine (<1%). The solvent combination is to be examined for its ability to generate sharp folic acid peaks; if successful, the solvent's ability, first, to separate folic acid from dihydrofolate and, second, their polyglutamates from each other will be investigated.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10337-01 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Nuclear Medical Imaging

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

A. Markowitz	Electrical Engineer	BEIP, NCRR
J. Schmitt	Staff Fellow	BEIP, NCRR
W. Friauf	Chief, EEES	BEIP, NCRR
T. Tedder	Instrument Maker	BEIP, NCRR
B. Chidakel	Instrument Maker	BEIP, NCRR
J. Fessler	Instrument Maker	BEIP, NCRR
M. Greene	Senior Investigator	CC, NM

COOPERATING UNITS (if any)

Nuclear Medicine, CC

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering, CCIS

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.5	0.5	1.0

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Work towards a fully operational, dual planar imaging system continued during this period on both the electronic and mechanical elements of the system. The mechanical design of the imaging bed/support arms for the camera was finalized and during a period of several months, fabricated in final form. This unit is now in the Department of Nuclear Medicine and is available for use. Work on the electronic components of the system was accelerated. Installation and software of two data acquisition boards was completed permitting image data to be acquired with the MAC II microcomputer. Several iterations of hardware and software were undertaken resulting in a system capable of acquiring all forms of nuclear image data. Performance of the two (positron-sensitive photomultiplier tube based) scintillation cameras was intensively investigated and a body of performance data now exists that characterizes most of the essential properties of these tubes/cameras, eg. spatial resolution, spatial linearity, etc., as well as indicating important limitations, eg. spatial dependent tube gain. Correction circuits for improving spatial linearity and gain uniformity have been designed and are now being fabricated for testing.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER
Z01 RR 10338-01 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Resolution of Equipment Safety Incidents and Manufacturers' Recalls

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

R. Corsey	Electronic Engineer	BEIP NCRR
M. Evans	Safety Officer	DIR, CC
D. Henderson		DIR, CC

COOPERATING UNITS (if any)
OD, Clinical Center; Division of Engineering Services;
Clinical Care Instrumentation Section, NCRR

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Applied Clinical Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 0.5	**PROFESSIONAL:** 0.4	**OTHER:** 0.1

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

The Joint Commission on Accreditation of Health Care Organizations requires the Clinical Center to have a program to evaluate equipment failures and user errors. The principal features of this program are:

1. Investigation of incidents involving equipment and patients or visitors or employees.

2. Processing of recall notices sent by equipment manufacturers, safety organizations and government agencies.

3. Formulation of a plan of action to resolve safety hazards related to equipment.

4. Participation in the resolution of the safety hazards.

5. Participation in the evaluation of effectiveness of actions taken.

To accomplish the program we interview patients, medical and support staff and others involved in incidents involving clinical and non-clinical equipment. We work closely with the Safety Officer, Clinical Center and the Division of Safety to formulate and carry out corrective procedures. This often involves removal of equipment, modification of equipment by manufacturers and training of clinical staff. We also participate in the evaluation of corrective actions through our activity on hospital committees.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10339-01 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Radiological Science Research and Training Program

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

R.L. Levin	Biomedical Engineer	BEIP, NCRR

COOPERATING UNITS (if any)

None

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Mechanical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 0.6	**PROFESSIONAL:** 0.6	**OTHER:** 0.6

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither
  ☐ (a1) Minors
  ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

The NIH has been requested by Congress to expand its research to include aspects of radiology and imaging. To this end, an Office of Radiological Research and Training is being established. This program is being designed to give radiologists and others from the American radiological community training in research methodology and technique. Part of that training may include performing research with NIH staff scientists and clinicians on the latest techniques for (1) whole body magnetic resonance instrumentation, and (2) the visualization and analysis in multiple dimensions of multimodality medical images. To this end, additional NMR instrumentation and image processing hardware and software are being acquired.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10340-01 BEI

PERIOD COVERED

October 1, 1989 - September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Interstitial Pressure and Transport in Neural Tissue

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

P.J. Basser	Senior Staff Fellow	BEIP, NCRR
R. Plunkett, M.D.	Neurosurgery Branch	NINDS
K. Holloway, M.D.	Neurosurgery Branch	NINDS
H. Bobo, M.D.	Neurosurgery Branch	NINDS

COOPERATING UNITS *(if any)*

NINCDS

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Mechanical Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.2	0.2	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

A unified experimental and theoretical approach is employed to explain the pathophysiology caused by arterio-venous fistulae of the dura surrounding the spinal cord. Interstitial fluid pressure is monitored while this pathological shunt between the arterial and venous blood supplies is severed. A bi-phasic continuum model is being developed to explain the observed changes in interstitial fluid pressure following the procedure. The model consists of an equation of motion, a linear constitutive law of the tissue, Darcy's law, the conservation of mass of the tissue network and interstitial fluid and equations describing capillary and lymph transport. Since the model is general, i.e., it predicts the time-course and distribution of interstitial fluid flow, interstitial pressure, elastic stress, tissue displacement and fluid transport, it can describe transport in tumors and tissue edema.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10341-01 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Muscle Strength Testing System

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

T.R. Clem, Sr.	Electrical Engineer	BEIP, NCRR
S. Dinsmore, M.D.	DIR MN	NINDS
M. Dalakis, M.D.	DIR MN	NINDS

COOPERATING UNITS *(if any)*

DIR MN, NINDS

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Electrical and Electronic Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.5	0.4	0.1

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

There are a variety of neurological afflictions that reduce the strength in various muscle systems in the human body. It is desirable to make an accurate quantitative measurement of the strength of various muscle groups on normal subjects, subjects who have muscle deficiencies due to disease, and subjects who are undergoing either drug therapy or physical therapy to strengthen weakened muscles. This project involves the design of a computer-based system that will allow the researcher to follow the progress of muscle strength changes over a period of time. The first application will be for patients who are suffering from Post Polio Syndrome. The system is engineered to allow the clinician to efficiently make measurements on 18 different muscle groups, 9 on each side, in a minimum of time and with a minimum of discomfort to the test subject.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10342-01 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Computer Based Dual Pump HPLC Driver System

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

J.W. Cole	Electrical Engineer	BEIP, NCRR
R. Lippoldt	Biochemist	CE, NIDDK

COOPERATING UNITS (if any)

CE, NIDDK

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Electrical and Electronic Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.6	0.6	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

High Performance Liquid Chromatography (HPLC) is a common method used to separate various molecules on the basis of their size. The solution to be analyzed is passed through a long column packed with tiny beads. Larger molecules tend to have a more difficult time passing through the column while smaller molecules move more rapidly, leading to the desired size separation effect. By forcing the solution through the column under high pressure, chromatographic separations are achieved much faster and with greater resolution as compared to standard chromatographic methodologies. In most typical HPLC systems a single pump is used to drive the solution to be analyzed through the column.

Recently there has been interest in using a dual pump driver system. A system of this type would allow the reaction and by products of two chemical reactants to be studied and separated as the reaction proceeds and simultaneously passes through the column.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	**PROJECT NUMBER** Z01 RR10343-01 BEI

PERIOD COVERED
October 1, 1989 - September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
B-Spline Signal Processing Techniques

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

M. Unser	Visiting Scientist	BEIP, NCRR
A. Aldroubi	Staff Fellow	BEIP, NCRR
M. Eden	Chief	BEIP, NCRR

COOPERATING UNITS *(if any)*
None

LAB/BRANCH
Office of the Chief

SECTION
Biomedical Engineering and Instrumentation Program

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.0	1.0	

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

Conventional digital signal processing techniques consider signals that are represented by a set a uniformly spaced sampled values. Although most processing algorithms are derived within a purely discrete framework, there are a variety of biomedical problems (e.g. detection of anatomical structures in images, estimation of velocity from sequences of x-y coordinates) that would be better formulated by considering a signal as a continuous real-valued function defined over some domain. This study is concerned with the development of new processing techniques that represent signals by continuous polynomial spline functions.

Traditionally, polynomial spline interpolation or approximation problems are approached using a matrix formulation. Our main contribution has been to recognize that, in the context of signal processing (equally spaced data points), a solution can be obtained by digital filtering. In particular, we have derived recursive filtering structures for the interpolation and least squares approximation of sequences of data points using polynomial splines of any order n. These techniques have been applied to the design of fast algorithms for image interpolation and compression.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10344-01 BE

PERIOD COVERED

October 1, 1989 - September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*

Computer Analysis of Ultrasound Images of the Tongue

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

M. Unser	Visiting Scientist	BEIP, NCRR
M. Stone	Speech Pathologist	DRM/CC

COOPERATING UNITS *(if any)*

DRM/CC

LAB/BRANCH

Office of the Chief

SECTION

Biomedical Engineering and Instrumentation Program

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.0	1.0	

CHECK APPROPRIATE BOX(ES)

☒ (a) Human subjects ☐ (b) Human tissues ☐ (c) Neither

☐ (a1) Minors

☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

An image processing system has been developed for a Macintosh II personal computer. It is designed to process individual sagittal tongue sections that are digitized in real time and stored in standard TIFF format. The successive processing steps are : (a) a prefilter for noise reduction, (b) a geometrical transformation (polar coordinates), (c) an enhancement of the tissue/air interface in the surface region of the tongue by matched filtering, and (d) an extraction of border points by searching for an optimal radial path along the angular dimension. This latter task is performed very efficiently using dynamic programming, which has the following advantages. First, the procedure is very robust due to the use of a global criterion to guide the detection. Second, the extracted contours are smooth as a result of appropriate restriction of the allowable transitions. Finally, the method allows an optional specification of some predefined contour points

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10345-01 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Functional Test Procedures for Medical Equipment

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

R. Corsey	Electronic Engineer	BEIP, NCRR
J. Bucolo	Electronics Tech.	BEIP, NCRR

COOPERATING UNITS (if any)

OD, Clinical Center; Division of Engineering Services;
Clinical Care Instrumentation Section, NCRR

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering, CCIS

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.5	0.3	0.2

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

The complexity of medical equipment necessitates annual testing to assure correct performance. In many cases these tests need to be tailored to a specific brand and model. The tests need to be less time consuming than a full calibration, but detailed enough to test important safety and efficacy features. In compliance with new standards required of the Clinical Center we have written testing procedures that give medical staff assurance that medical equipment works properly. These tests reflect Clinical Center experience with medical equipment as well as manufacturers' recommendations. For example, battery powered defibrillators are tested on a weekly basis using an abbreviated testing procedure to assure batteries are of sufficient capacity for emergency use. They are also tested on an annual basis to assure compliance with most manufacturer's specifications. The procedures are designed to be used by novice technicians under the direction of an experienced technician.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10346-01 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

Evaluation of AC Power Quality in the Clinical Center

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

R. Corsey	Electronic Engineer	BEIP, NCRR
J. Wilson	Building Services Manager	DIR, CC

COOPERATING UNITS (if any)

OD, Clinical Center; Division of Engineering Services, NCRR

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering, CCIS

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.3	0.3	

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

The computerization of medical equipment and clinical chemistry equipment has resulted in numerous malfunctions due to inadequate quality of AC power. The AC power system in the Clinical Center was designed in the 1960's before the advent of computerization of equipment. We have witnessed malfunctions of respirators and clinical chemistry equipment used to analyze blood and urine samples from patients. The malfunctions have been related to voltage sags, surges and transients. In some cases they were due to improper selection of power conditioning devices such as surge suppressors and uninterruptible power supplies. We have tested a number of power conditioning devices, and along with manufacturer recommendations, have solved numerous power quality problems. We have selected several surge suppressors which can pass the stringent leakage current requirement of hospital equipment. Additionally, we have selected several uninterruptible power supplies and transformer power conditioners able to cope with the frequent voltage sags encountered in the hospital. To assure new medical equipment can function properly without extra power conditioning we participate in evaluation of clinical trials where equipment is tested prior to purchase.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10347-01 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Evaluation of Medical Equipment for Use in the Clinical Center

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

R. Corsey	Electronic Engineer	BEIP, NCRR
L. Eldridge	Associate Hospital Administrator	DIR, CC

COOPERATING UNITS (if any)
OD, Clinical Center; Clinical Care Instrumentation Section, NCRR

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Applied Clinical Engineering, CCIS

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.4	0.3	0.1

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

The increasing complexity of clinical and non-clinical equipment used in hospitals has necessitated the formation of a Standardization Committee by the Clinical Center. We provide engineering expertise to the committee. The purpose of the Standardization Committee is to stem the uncontrolled acquisition of equipment and supplies manufactured by different manufacturers. For example, in the past the hospital had infusion pumps in use from three different manufacturers where one brand and even one model would suffice. This led to unnecessary difficulties of training medical staff, stocking parts to repair the pumps and training technicians to perform repairs. The hospital has standardized on one brand and two models since the standardization effort began. Our contribution to this effort is to provide technical evaluation of equipment before and after purchase. To accomplish this we participate in site visits to manufacturers' facilities and user facilities, interview engineering and medical staff who have used prospective equipment and perform tests to determine product performance. We also maintain liaison with various standards making organizations and testing organizations to provide a perspective from sources outside NIH.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

Z01 RR 10348-01 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

An Infrared Strobe CCD Television Camera Unit

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

H.E. Cascio	Electronic Engineer	BEIP, NCRR
P.D. Smith	Physicist	BEIP, NCRR
S. Stanhope	Biomechanist	BL, CC

COOPERATING UNITS (if any)

Biomechanics Laboratory, CC

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Electrical and Electronic Engineering

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 0.5	PROFESSIONAL: 0.2	OTHER: 0.3

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

The Biomechanics Laboratory makes available to clinicians and researchers at the NIH quantitative information concerning human motion. The Laboratory has a computer-operated television motion analysis system (VICON) to acquire and evaluate data. The system detects the presence of reflective markers located on the patient and calculates the three dimensional location of each marker. The problems with persistence, blooming, and electronic stability of the vidicon cameras makes the balancing and calibration of the six cameras difficult. Also, problems with video overload are encountered when a strobed infrared (IR) Light Emitting Diode (LED) array is viewed by another camera.

The solution is to replace the vidicon cameras with .CCD cameras, which have superior electronic stability and do not display picture smearing when detecting fast motion. Each camera has a strobed IR array to illuminate the field of view. To eliminate the illumination cross-talk between cameras, each IR array is equipped with IR emitters with wavelengths of either 880nm or 950nm. An IR band-pass filter that matches the wavelength of the array is placed over the camera lens.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE **NOTICE OF INTRAMURAL RESEARCH PROJECT**	PROJECT NUMBER Z01 RR 10349-01 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT *(80 characters or less. Title must fit on one line between the borders.)*
Image Field Modification for Quantitative Microscopy

PRINCIPAL INVESTIGATOR *(List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)*

P.D. Smith	Physicist	BEIP, NCRR
M. Alley	Senior Investigator	FCRF, NCI

COOPERATING UNITS *(if any)*
FCRF, NCI

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Electrical and Electronic Engineering

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.5	0.4	0.1

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK *(Use standard unreduced type. Do not exceed the space provided.)*

A quantitative video microscope was modified to provide selectable reduced fields for screening of cellular media. Two approaches are being evaluated in trials: first, a modification of the objective lens; and second, a modification of the final image path to the video camera. The latter has the advantage of being less system specific in future application to other microscopes.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER
Z01 RR 10350-01 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Nuclear Magnetic Resonance (NMR) Instrumentation

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

D.I. Hoult	Physical Scientist	BEIP, NCRR
C-N Chen	Physical Scientist	BEIP, NCRR
L.K. Hedges	Staff Fellow	BEIP, NCRR
R. Turner	Visiting Scientist	BEIP, NCRR

COOPERATING UNITS (if any)

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Nuclear Magnetic Resonance Instrumentation

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS: 4	**PROFESSIONAL:** 4	**OTHER:**

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

BEIP continues to explore and support the numerous research opportunities presented by the *in vivo* application of nuclear magnetic resonance. Work has focused on four main areas: 1) the design and construction of specialized radio frequency coils which have a highly homogeneous irradiating field, and which, in conjunction with a specialized preamplifier and transmitter, give a constant, high sensitivity signal while probe loading changes; 2) the development of new spin-massaging techniques, in particular, the application of noise pulses with a surface coil to produce rapid spatial localization; 3) the development and implementation of v various echo-planar imaging techniques--a method which aims to produce images in under 100ms--using a new gradient coil design, and 4) the support and improvement of the VAX, SUN, Macintosh and Bruknet computers via networking and the addition of new software.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER

ZO1 RR 10351-01 BEI

PERIOD COVERED

October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)

High Resolution Patch Clamp Techniques

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

A. Markowitz	Electrical Engineer	BEIP, NCRR
B. Chidakel	Electronic Technician	BEIP, NCRR
T. Tedder	Mechanical Technician	BEIP, NCRR
E. Rojas	Senior Investigator	LCBG, NIDDK
P. Caviedes	Senior Investigator	LCBG, NIDDK
F. Vargas	Senior Investigator	LCBG, NIDDK

COOPERATING UNITS (if any)

Laboratory of Molecular Biology, NIDDK

LAB/BRANCH

Biomedical Engineering and Instrumentation Program

SECTION

Applied Clinical Engineering Section

INSTITUTE AND LOCATION

NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
1.5	0.5	1.0

CHECK APPROPRIATE BOX(ES)

☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
- ☐ (a1) Minors
- ☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

Five patch clamp installations, either setup or in the process of being setup, will measure the membrane properties of electrically and chemically excitable cells. These installations will lead to the precise measurement of the ionic currents under excitation. From these measurements it is possible to obtain exact descriptions of the ion conductance changes that occur in response to electrical and chemical stimuli.

DEPARTMENT OF HEALTH AND HUMAN SERVICES - PUBLIC HEALTH SERVICE

NOTICE OF INTRAMURAL RESEARCH PROJECT

PROJECT NUMBER
Z01 RR 10352-01 BEI

PERIOD COVERED
October 1, 1989 to September 30, 1990

TITLE OF PROJECT (80 characters or less. Title must fit on one line between the borders.)
Quantitative Characterization of Ciliated Tracheal Epithelial Cell Cultures

PRINCIPAL INVESTIGATOR (List other professional personnel below the Principal Investigator.) (Name, title, laboratory, and institute affiliation)

J.R. Ellis	Senior Staff Fellow	BEIP, NCRR
Dr. L. DeLuca		DCE/NCI
Dr. F. Langilotti		DCE/NCI

COOPERATING UNITS (if any)
DCE/NCI

LAB/BRANCH
Biomedical Engineering and Instrumentation Program

SECTION
Applied Clinical Engineering Section

INSTITUTE AND LOCATION
NCRR, National Institutes of Health, Bethesda, MD 20892

TOTAL MAN-YEARS:	PROFESSIONAL:	OTHER:
0.1	0.1	0.0

CHECK APPROPRIATE BOX(ES)
☐ (a) Human subjects ☐ (b) Human tissues ☒ (c) Neither
☐ (a1) Minors
☐ (a2) Interviews

SUMMARY OF WORK (Use standard unreduced type. Do not exceed the space provided.)

The number and size of ciliated cells and non-ciliated cells in bronchial epithelium cultures are important descriptors of patterns of fetal growth, recovery from injury, response to dietary deficiency, and carcinogenesis. Most work published to date about these cell sub-populations has been descriptive in nature. Investigation of methods to determine the number and relative areas of such sub-populations quantitatively is proposed. Initial efforts will be directed toward making cost and time estimates of procedures making maximal use of existing hardware and facilities.

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